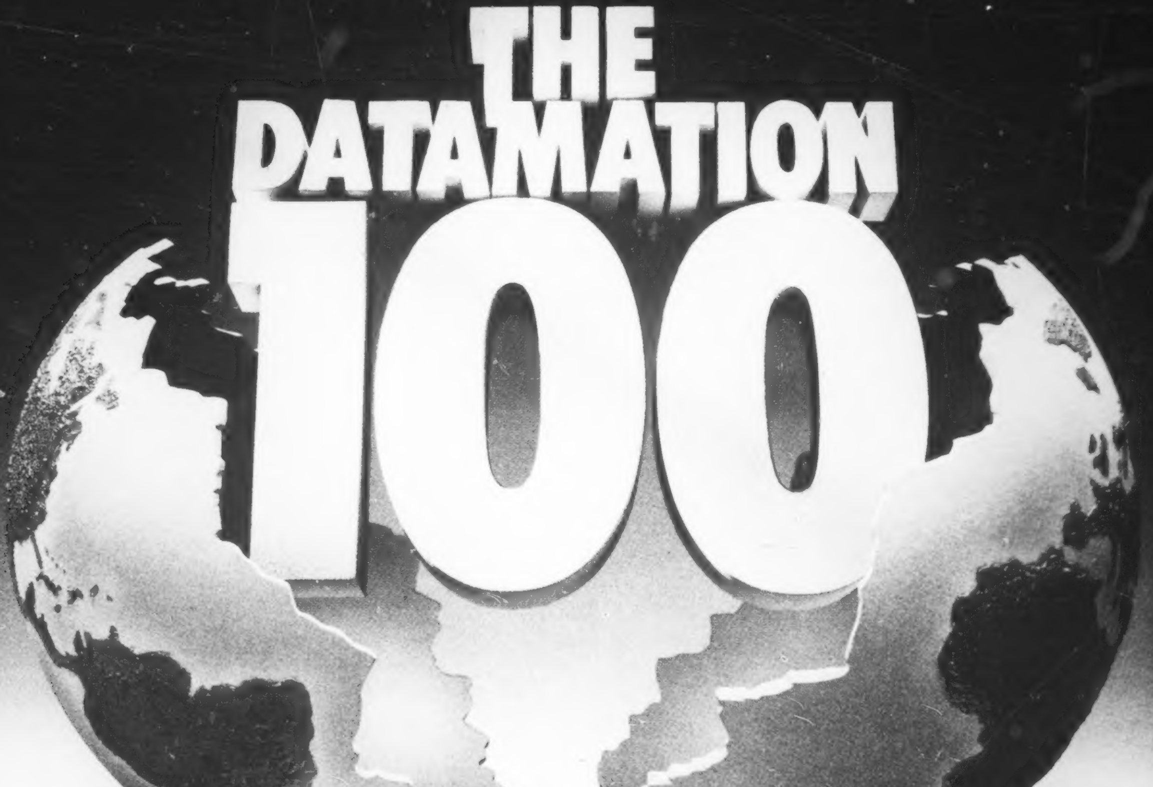
DATAMATION

JUNE 15, 1988
A CAHNERS PUBLICATION

Inside the Worldwide IS Industry



Exclusive:

- Profiles of the Top 100 Companies Worldwide
- Financial Data on the Top 100 U.S. Vendors
- Financial Data on the Top 50 International Vendors
- Analysis by Experts from the U.S., Europe, and Japan

THE DATAMATION 100

JUNE 15, 1988
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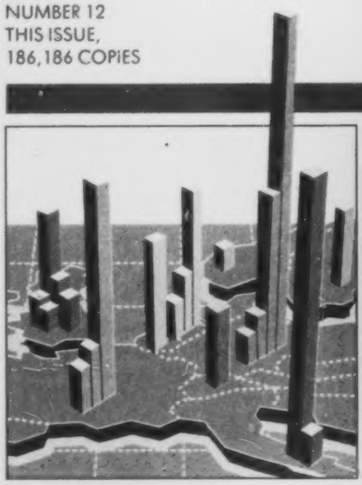

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1987-The Year

CHARTING THE CHAMPS. The financial house IS built withstood the Wall Street crash. The world's top 100 IS firms took in $208.9 billion, representing 80% of the total worldwide industry; only six lost money. The low dollar affected most results. Despite surface stability, individual vendors' fortunes shifted, as did some technologies' relative importance.

[redacted]

Financial Data

THE NUMBERS. Extensive breakdowns of the year's results for the 100 leading U.S. IS companies and the 50 leading non-U.S. IS companies. Plus, the revenue totals of the DATAMATION 100—the world's leading 100 IS companies.

[redacted]

100 Company Profiles

THE INSIDE STORIES. Up close and personal with the companies of the DATAMATION 100, including breakdowns of the top 50 companies' IS revenue by technology sector.

[redacted]

Alphabetical Index of Datamation 100 Companies

Including a guide to the pages on which financial data appears for 150 firms.

[redacted]

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WORLDWIDE PICTURE. Experts from the Brookings Institution, the Mitsubishi Research Institute, and the European Commission's Directorate General for Telecommunications, Information Industries & Innovation probe their regional IS industry's place in the world's economy.

[redacted]

21 Technology Perspectives

MARKET CLOSE-UPS. DATAMATION invited vendors from the U.S., Europe, and the Far East in mainframes, minis, micros, software, peripherals, services, and datacom to share their views on the activity in their markets in '87, and where they are going in '88. With charts showing the leaders in each sector.

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1988-What's Ahead

THE AGE OF VOLATILITY. For the most part, the DATAMATION 100 companies are flushed with financial and technological success. So, why are top execs nervous? Because users' needs are changing, their horizons widening. If vendors can't keep up, today's blooming fortunes may be tomorrow's withered rose.

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Cover by Walter Wick

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Inside the DATAMATION 100

Methodology

Throughout the year, DATAMATION collects information on more than 200 companies on a worldwide basis. The companies are then ranked according to their IS revenues for the calendar year. All revenue and earnings figures in the current DATAMATION 100 are for calendar year 1987. Because many companies operate on a fiscal year that does not coincide with the calendar year, some data, such as expenditures on research and development, are reported as of the company's most recent fiscal year's end.

For the purposes of the DATAMATION 100 survey, information systems revenues are defined as being derived from sales of the following: computer systems, including mainframes, minicomputers, microcomputers, personal computers, workstations, word processors, office systems, and CAD/CAM systems; peripherals, including terminals, printers, plotters, disk drives, tape drives, magnetic media, and data entry devices; software, including operating systems and applications programs; data communications equipment, including communications processors, LANs, digital PBXs, multiplexors, modems, and facsimile machines; data services, including custom programming, systems integration, consulting, timesharing, and remote processing; maintenance and repair; computer leasing; and point-of-sale systems and automated teller machines.

Explicitly excluded are the following: data transmission or "basic" services from specialized common carriers that are not integrated with a data processing service; standalone electronic or mag card typewriters; standalone electronic cash registers; instrumentation; semiconductors; printed circuit boards; automatic test equipment; IS supplies, with the exception of magnetic media for disk and tape drives; industrial control devices; central office telephone switches; analog PBXs; and computer-output-micrographic systems.

Figures listed in the DATAMATION 100 for mainframes and minicomputers represent only the sale of the processor itself; figures for peripherals and software that are sold as part of a system are grouped into the peripherals and software categories.

Whenever possible, information in the DATAMATION 100 is obtained from the companies themselves. When a company will not provide information, or will not provide it in a form suitable for this survey, we have estimated the figures based on investigative reporting coupled with an analysis of industry trends.

The net income reported for each company represents total earnings, not just earnings from information systems revenues. Revenues derived from sales to other divisions or units within a company are considered captive sales and are not included in this survey.

Contributors

The entire staff of DATAMATION labors long and hard to write, edit, and produce the annual DATAMATION 100 issue, the world's most comprehensive picture of the global information technology industry. Reporters in our bureaus throughout the United States, and in London and Tokyo, aided by correspondents in France, Italy, West Germany, Hong Kong, and South Korea, investigate and profile the leading companies of the international IS industry, wherever they are found.

Special thanks are due to contributing editor Joseph Kelly, who cajoles and badgers over 200 companies to assemble the financial data on which the survey is based. International editor Paul Tate, with Tokyo bureau manager Robert Poe and London editorial assistant Lauren Murphy, put together the non-U.S. data. Senior editor Linda Runyan, helped by editorial secretary Anne Mangieri, coordinated the Macroeconomic Views and the Technology Perspectives. Administrative help was provided by editorial assistant Karen J. Scher. Reporting and writing the profiles that begin on page 42, were Theresa Barry, Eric Brand, David R. Brousell, Ralph Emmett Carlyle, James Etheridge, Mary Kathleen Flynn, Robert Francis, Oles Gadacz, Karen Gullo, Joseph Kelly, Susan Kerr, Steven Korn, John Lamb, Janette Martin, Tom McCusker, Gary McWilliams, Jeff Moad, Edith D. Myers, Willie Schatz, Paul Tate, and Peggy Trautman.

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MANAGING EDITOR/PRODUCTION
& SPECIAL PROJECTS

THE DATAMATION 100

1987-The Year

CHARTING THE CHAMPS

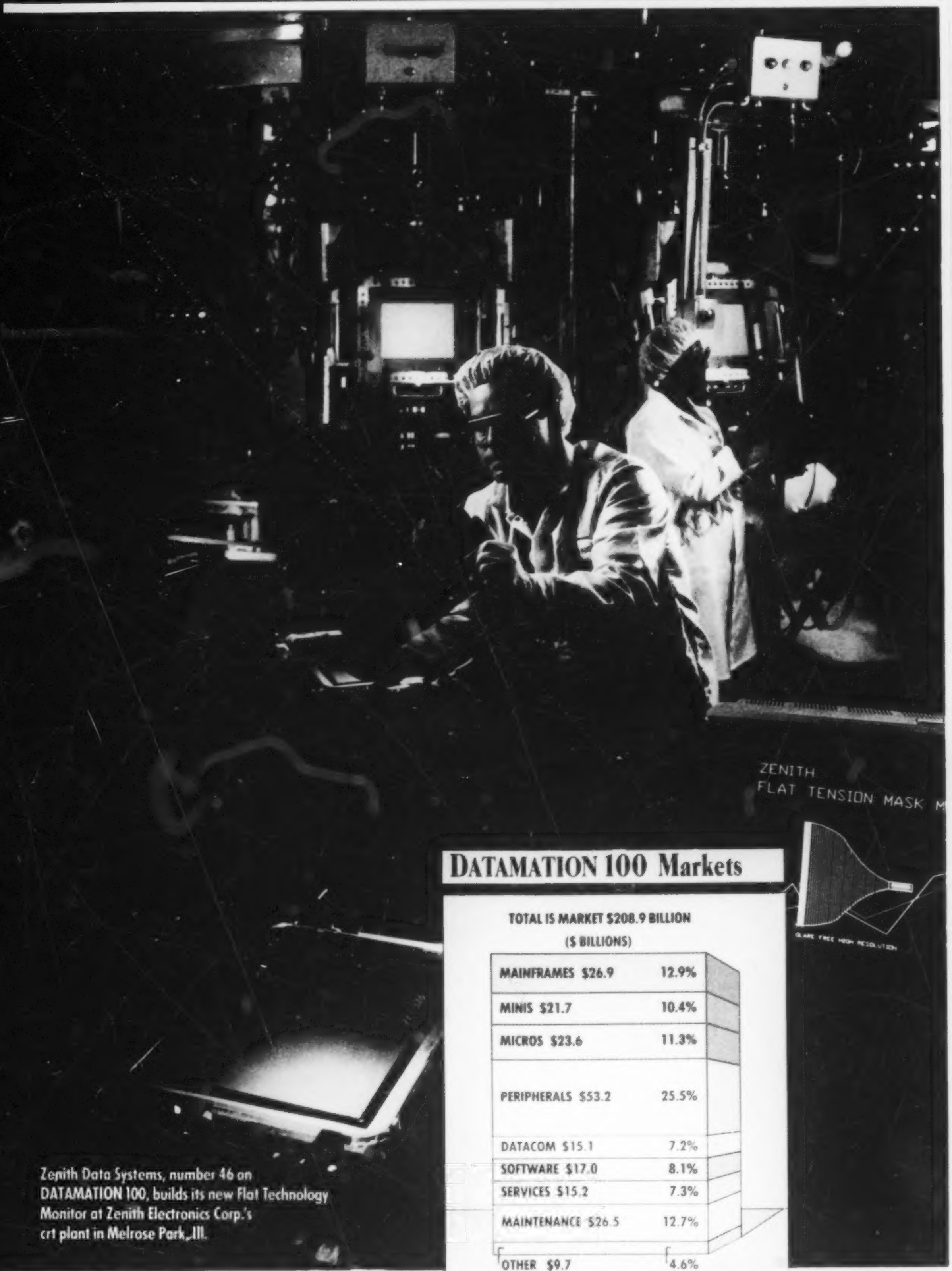
It was a sunny year for almost every IS company. But shadows fell on IBM's domestic sales, and on some mini makers.

The biggest business story of 1987—the crash of the international financial markets—may have been the year's most misleading one. For all the drama, for all the fear created by Oct. 19's domino disaster, the crash did not strike a mortal blow against worldwide business. Especially for the worldwide information systems and technology industry, 1987 could only be called a very good year.

The DATAMATION 100 this year paints a glowing picture of an international IS industry that is healthier and more prosperous than ever. The revenues and profits of the world's 100 leading IS companies are up—and dramatically so.

The total IS revenues of the companies on this year's DATAMATION 100 list are $208.9 billion—18.7% greater than the IS sales of the 100 leading companies last year. Arthur D. Little Inc. estimates global IS sales for all compa-

Illustration by Darryl Ligason


ZENITH
FLAT TENSION MASK M
GLARE FREE HIGH RESOLUTION

Zenith Data Systems, number 46 on DATAMATION 100, builds its new Flat Technology Monitor at Zenith Electronics Corp.'s crt plant in Melrose Park, Ill.

DATAMATION 100 Markets

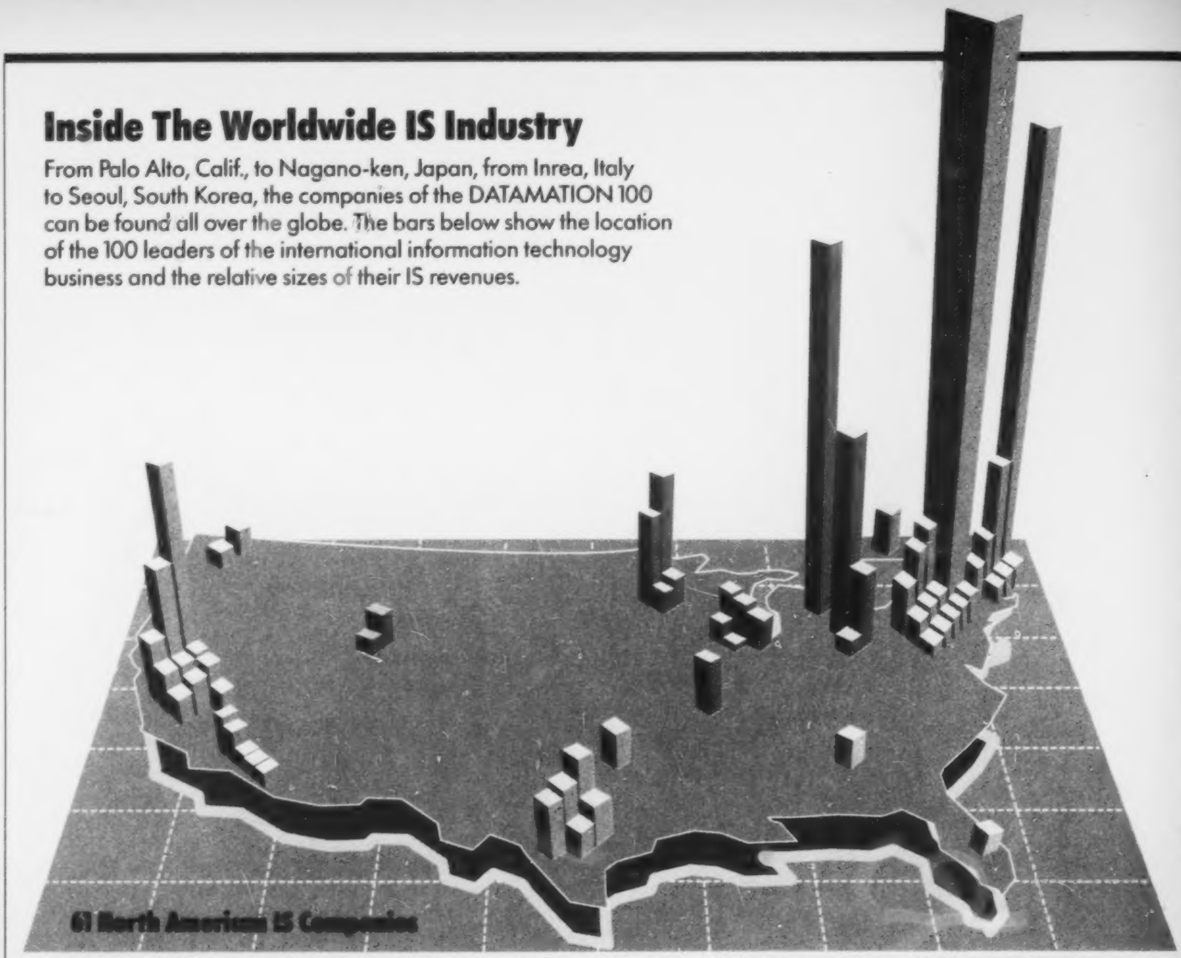
TOTAL IS MARKET $208.9 BILLION
($ BILLIONS)

MAINFRAMES $26.9	12.9%
MINIS $21.7	10.4%
MICROS $23.6	11.3%
PERIPHERALS $53.2	25.5%
DATACOM $15.1	7.2%
SOFTWARE $17.0	8.1%
SERVICES $15.2	7.3%
MAINTENANCE $26.5	12.7%
OTHER $9.7	4.6%

(All figures are rounded off)

Inside The Worldwide IS Industry

From Palo Alto, Calif., to Nagano-ken, Japan, from Inrea, Italy to Seoul, South Korea, the companies of the DATAMATION 100 can be found all over the globe. The bars below show the location of the 100 leaders of the international information technology business and the relative sizes of their IS revenues.



Rank	Company	Location	Tot. Rev.
	NORTH AMERICA		
	▨ CANADA		**$900**
51.	Northern Telecom	Mississauga, Ont.	$900.0
	▨ WEST COAST		**$18,195.2**
9.	HP	Palo Alto	$5,000.0
13.	Apple	Cupertino, Calif.	$3,041.2
29.	Amdahl	Sunnyvale, Calif.	$1,505.2
41.	CSC	El Segundo, Calif.	$1,133.8
43.	Tandem	Cupertino, Calif.	$1,089.6
44.	Seagate	Scotts Valley, Calif.	$1,075.7
47.	National Semi	Santa Clara	$985.0
56.	Sun Microsystems	Mountain View, Calif.	$755.9
73.	Lockheed	Calabasas, Calif.	$553.0
78.	Microsoft	Redmond, Wash.	$406.7
79.	Xidex	Palo Alto	$455.7
87.	Wyse	San Jose	$396.2
90.	Convergent Tech.	San Jose	$384.8
92.	Tandon	Chatsworth, Calif.	$374.0
96.	MAI	Tustin, Calif.	$334.2
96.	Dataproducts	Woodland Hills, Calif.	$334.2
99.	Tektronix Inc.	Beaverton, Ore.	$320.0
	▨ WEST		**$1,112.5**
57.	StorageTek	Louisville, Colo.	$750.0
94.	MiniScribe	Longmont, Colo.	$362.5
	▨ SOUTHWEST		**$6,206.6**
25.	Tandy	Fort Worth	$1,682.4
31.	EDS	Dallas	$1,440.5
37.	Compaq	Houston	$1,224.1
54.	Telex	Tulsa, Okla.	$788.9
59.	TI	Dallas	$748.0
98.	Datapoint	San Antonio	$320.7
	▨ MIDWEST		**$27,533.3**
3.	Unisys	Detroit	$9,742.0
8.	NCR	Dayton, Ohio	$5,075.7
15.	CDC	Minneapolis	$3,000.9
21.	Honeywell Bull	Minneapolis	$2,050.0
24.	TRW	Cleveland	$1,900.0
35.	McDonnell Douglas	St. Louis	$1,241.8
39.	Comdisco	Rosemont, Ill.	$1,153.0
46.	Zenith	Glenview, Ill.	$1,040.0
58.	Arthur Andersen	Chicago	$748.9

nies approached $255 billion in 1987, meaning that those IS revenues generated by companies large enough to make the DATAMATION 100 represent more than 80% of the globe's IS industry.

Profits for the DATAMATION 100 also are robust—27.2% ahead of last year. Red ink, in fact, is rare: just six companies among the DATAMATION 100 actually lost money in 1987, the year upon which the new DATAMATION 100 rankings are based. These six companies lost only $311 million—less than half the sum dropped by the 12 money losers on last year's list. Not since the DATAMATION 100 went international in 1984 has so little money been lost among the leaders of the IS industry.

The Dollar's Impact on IS Suppliers

Amidst these "up" numbers, however, one number continued to go down and continues to reshape the IS industry. The U.S. dollar—once almost universally deemed "almighty"—shrunk even further in 1987, falling 14.2% against the yen and 17.2% against the deutsche mark. The weakened greenback's impact on the DATAMATION 100 is clearly evident, though difficult to measure. It does somewhat distort the performance of IS vendors based outside the United States. Fujitsu and NEC, for example, generated revenue increases of 14.1% and 11.7%, respectively, in their native yen; yet they look as if they achieved 30%-plus growth in terms of U.S. dollars. The lower dollar also helps U.S.-based IS manufacturers sell their products domestically—because they're cheaper than imports—and abroad—because they can be priced more competitively.

The currency factor certainly played a part in displacing five U.S.-based companies from the ranks of this year's DATAMATION 100, which consists of 60 U.S. vendors, 22 European companies, 16 Japanese enterprises, and one firm each from Canada and South Korea.

Statistical anomaly is the least of the weakened dollar's effects, however. Japanese companies, particularly dependent on exports to the U.S., found the export percentage of their sales

Maps by Jim Ludtke; Source: DATAMATION

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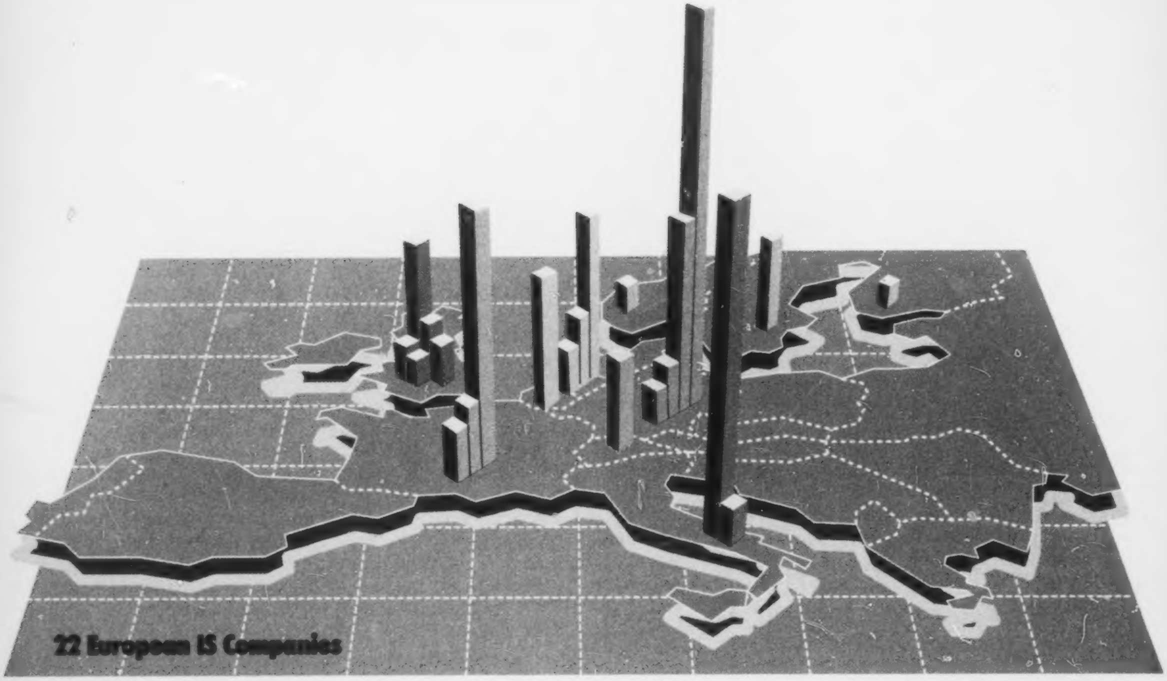


Rank	Company	Location	Tot. Rev.
60.	Motorola	Schaumberg, Ill.	$724.9
61.	Cray Research	Minneapolis	$687.3
80.	3M	St. Paul	$455.0
95.	Diebold	Canton, Ohio	$345.5
100.	Gould	Rolling Meadows, Ill.	$299.3
▨	**SOUTH**		**$1.087.1**
67.	Intergraph	Huntsville, Ala.	$641.1
81.	Harris	Melbourne, Fla.	$446.0
▨	**EAST COAST**		**$78,336.0**
1.	IBM	Armonk, N.Y.	$50,485.7
2.	DEC	Maynard, Mass.	$10,391.3
12.	Wang	Lowell, Mass.	$3,045.7
19.	Xerox	Stamford, Conn.	$2,415.0

Rank	Company	Location	Tot. Rev.
23.	AT&T	New York	$2,000.0
30.	ADP	Roseland, N.J.	$1,467.0
32.	Data General	Westboro, Mass.	$1,303.9
49.	Prime	Natick, Mass.	$960.9
53.	GE	Fairfield, Conn.	$800.0
55.	Commodore	West Chester, Pa.	$785.0
63.	Martin Marietta	Bethesda, Md.	$685.7
66.	Computer Assoc.	New York	$648.8
68.	Bell Atlantic	Philadelphia	$634.9
71.	Computervision	Bedford, Mass.	$564.0
72.	Apollo	Chelmsford, Mass.	$553.6
84.	Continental IS	Syracuse, N.Y.	$405.4
85.	Emhart	Hartford, Conn.	$404.8
88.	Lotus	Cambridge, Mass.	$395.6
89.	Shared Medical Sys.	Malvern, Pa.	$390.7

(All figures are in millions of dollars)

Rank	Company	Location	Tot. Rev.
		EUROPE	
▨	**UNITED KINGDOM**		**$4,563.8**
20.	STC plc	London	$2,123.0
50.	Atlantic	London	$950.0
74.	Racal	Berkshire	$549.1
75.	Amstrad	Essex	$533.0
86.	Ferranti	Cheshire	$398.8
☐	**BELGIUM AND THE NETHERLANDS**		**$6,369.1**
18.	Philips	The Netherlands	$2,601.6
22.	Alcatel	Brussels, Belgium	$2,052.1
45.	Memorex	The Netherlands	$1,041.1
55.	Econocom Intl.	The Netherlands	$674.3

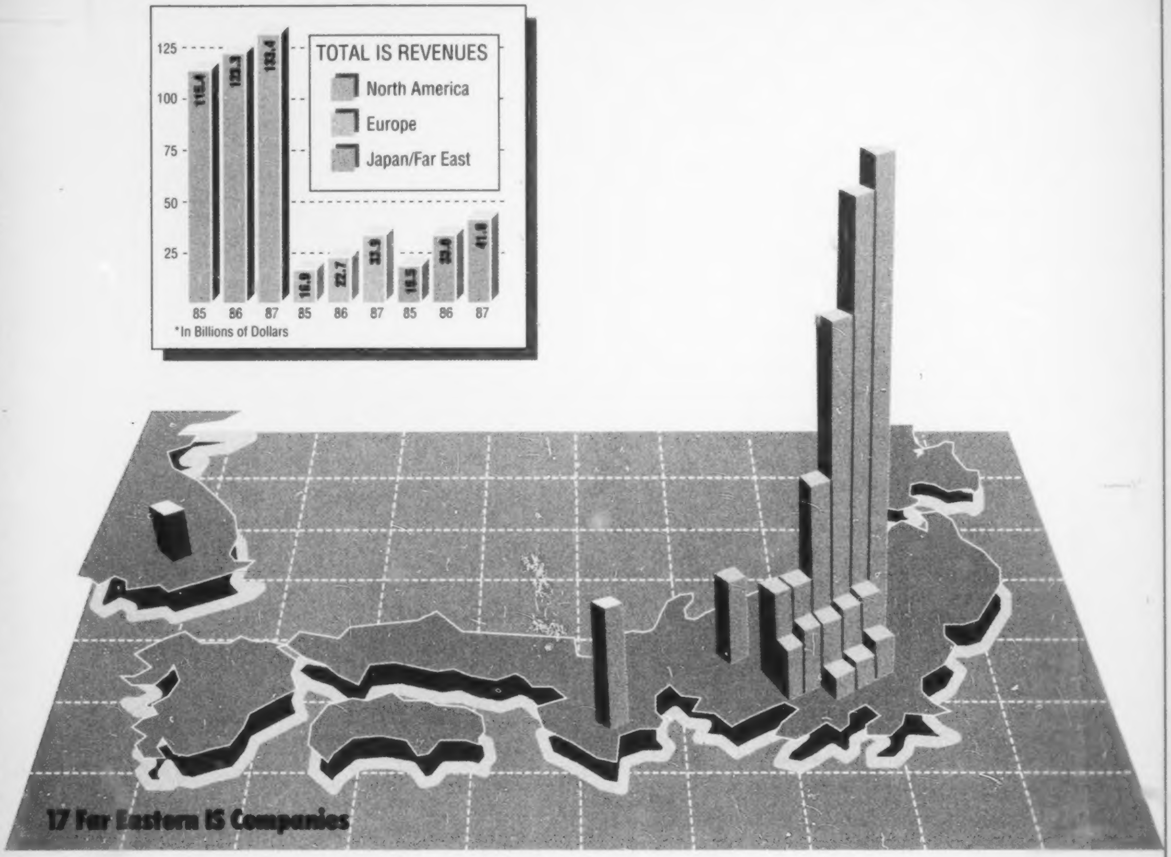
dropping. Sony's export ratio fell 5%, to 63%; Matsushita's was down 4%, to 29%; NEC and Hitachi were both off 2%, to 27% and 28%, respectively. Toshiba's U.S. sales were off 10% for the year. Mitsubishi's micro sales plummeted 28%: the dollar has made its machines too expensive to appeal to the U.S. oem companies that resell them. Two Japanese companies, Canon and Ricoh, are exporting more IS equipment to the U.S., primarily because nobody in the U.S. produces a competitor for the hot facsimile machines they make.

Most of the improvement in IS revenues for Japanese companies came from their home economy, stimulated by government projects and an unprecedented wave of Japanese consumer spending. Two trends also helped raise the IS tally in Japan: the Japanese financial industry's massive shift to a new generation of computer systems helped the mainframers, and the belated move toward office automation by corporate Japan was good news for its micro makers. With annual growth of about 4% forecast for the Japanese economy during 1988, sales to local businesses will help replace lost IS exports.

Japanese Moves Benefit U.S. Workers

The direct beneficiaries of moves by Japanese giants to retain their foreign markets have been U.S. workers. The market in which they are situated and the cheapness of the dollars in which they are paid has made American manufacturing workers an international bargain. From coast to coast, the Japanese are opening new production facilities for IS equipment. Fujitsu makes disk drives in Oregon and communications equipment in Dallas. Toshiba builds laptops in Irvine, Calif. Canon builds laser printers in Virginia. Oki makes printers in Atlanta. Seiko makes pcs in Oregon. Alps is building keyboards, mouse devices, and 5¼-inch floppy disk drives in Garden Grove, Calif.

For U.S.-based IS companies, the drooping dollar has been happy news, for the most part. Imported goods have grown more expensive in the U.S. home market, and U.S. exports are seen as



17 Far Eastern IS Companies

Rank	Company	Location	Tot. Rev.
	FRANCE		**$4,659.9**
14.	Groupe Bull	Paris	$3,007.5
48.	Société Générale	Paris	$870.1
64.	Cap Gemini	Paris	$682.3
	WEST GERMANY		**$9,741.3**
7.	Siemens	Munich	$5,703.0
16.	Nixdorf	Paderborn	$2,821.5
62.	Mannesmann	Düsseldorf	$686.0
76.	Comparex Info. Sys.	Mannheim	$530.8
	SWITZERLAND		**$1,225**
36.	Inspectorate Intl.	Neuchatel	$1,225.0
	SCANDINAVIA		**$2,309.5**
28.	Ericsson	Stockholm, Sweden	$1,511.6
83.	Norsk	Oslo, Norway	$422.6
91.	Nokia	Helsinki, Finland	$375.3
	ITALY		**$5,061.3**
10.	Olivetti	Ivrea	$4,637.2
82.	Finsiel	Rome	$424.1
	THE FAR EAST		
	JAPAN		**$41,010.0**
4.	Fujitsu	Tokyo	$8,748.0
5.	NEC	Tokyo	$8,230.5
6.	Hitachi	Tokyo	$6,273.7
11.	Toshiba	Tokyo	$3,441.4
17.	Matsushita	Osaka	$2,628.5
26.	Mitsubishi	Tokyo	$1,673.9
27.	Canon	Tokyo	$1,673.4
33.	NUK	Tokyo	$1,294.6
34.	Ricoh	Tokyo	$1,275.7
38.	Seiko Epson	Nagano	$1,198.4
40.	Oki Electric	Tokyo	$1,137.3
42.	NTT	Tokyo	$1,128.5
52.	C. Itoh	Tokyo	$729.2
69.	Alps	Tokyo	$632.5
77.	CSK	Tokyo	$486.9
93.	Sony	Tokyo	$365.5
	SOUTH KOREA		**$569.9**
70.	Samsung	Seoul	$569.5

bargains in Europe and the Far East. At IBM, for example, non-U.S. sales grew 13.1% while domestic revenues declined 1.7% in 1987. Big Blue estimates that the lower value of the dollar improved its 1987 total revenue by $3.47 billion, more than 6%, and pumped up profits by $615 million, almost 12%.

IBM isn't the only company finding rich fields abroad. NCR's non-U.S. sales were up 24%—more than triple the 7% growth in its domestic business. Foreign IS sales now account for 55% of NCR's revenues. Hewlett-Packard's non-U.S. sales jumped 22% last year—double the growth it experienced at home.

1992 Arrives Early In Europe

In Europe, the big news was the midyear passage by the European Parliament of the Single European Act. This legislation aims at transforming the nations of Europe, producing a single market with uniform technical and trading standards by 1992. Many steps will have been completed well before 1992. For example, as of April 1988, all public procurement of IS equipment costing more than $100,000 is open to bids from any vendor in the European Community. In 1990, the European Telecommunications Standards Institute will serve as a single approval point for all telecom terminal equipment sold in Europe.

The region has, in fact, been a single market for some vendors for some time. But "it is a perceptual change," says Robb Willmot, former head of ICL and TI Europe and now the head of Oasis, a London-based consulting firm. So, European companies are preparing for the realities that will be created by new perceptions. Among the reactions were three major linkups, direct responses to the new pan-European marketplace: Nokia's acquisition of Ericsson's Information Systems, Northern Telecom's purchase of a 24% stake in STC, and the merger of Scicon and Systems Designers, creating Europe's second largest software house (Cap Gemini, which has grown significantly through acquisitions, is still number one).

Some realities that IS vendors faced in Europe last year were a sluggish West German economy, a lively Spanish market, and a healthy appetite for leasing throughout the region. In 1987, West Germany remained the largest market in Europe, but GNP growth at a snail's pace held IS sales down. The most booming Continental market is Spain, still feeling the effects of post-Franco liberalization. Leasing, meanwhile, proved again to be one of the heartiest sources of growth for some European firms: leasing is the method of acquisition for almost a third of all large systems installed in Europe.

Vendors Stable, Technologies Dynamic

Examining the DATAMATION 100 by vendor and technology is also revelatory. On the surface, there is remarkable stability: the top 26 companies are the same ones that headed last year's survey, with the exception of Alcatel, and the pecking order of technologies (as a percentage of industry revenues) has hardly changed. But the fortunes of some individual vendors shifted, as did the relative importance of some technologies—notably software.

Although the top six companies on this year's DATAMATION 100 were in the top six last year, a couple of the giants seem sleepy. List leader IBM and third-place Unisys both posted pallid IS revenue increases—5.9% and 6.8%—lower than 80 of their fellows on the DATAMATION 100. Digital Equipment Corp., reporting a muscular 23.5% growth, is solidly in second place this year. (Unisys this year restated its 1986 numbers, revealing that it should have trailed DEC on last year's list as well.) NCR and Siemens overtook Hewlett-Packard, causing it to slide from No. 7 to No. 9 in worldwide IS rankings.

A look at the technology sectors that make up the $208.9 billion total IS revenues of the DATAMATION 100 shows that mainframes grew by 14.8% to $26.9 billion. (Mainframe revenues for 1986 were restated, reflecting revised estimates for several companies, including IBM, Unisys, Honeywell, and Control Data.) But the big machines' share of the overall IS market continued to decline, dropping to 12.9%. IBM, Unisys, Groupe Bull, and Siemens saw mainframe sales virtually at a standstill. Brisk sales of used 308X machines had held down IBM's 309X sales, but observers say IBM has finally flushed the old machines out of the pipeline. Beefed-up 309X performance should be good news for IBM mainframe sales in 1988. (IBM's first-quarter 1988 results show an improvement of 13% over its 1987 performance for the same quarter.) The Japanese troika—Fujitsu, NEC, and Hitachi—

Growth Spurts

RANKED BY PERCENT INCREASE IN IS REVENUE

	DTM 100 RANK	COMPANY	IS REV. IN LOCAL CURRENCY (MIL.)		% INCREASE
			1987	1986	
1	36	Inspectorate Intl.*	SFr1,835.3	SFr182.0	908.4
2	66	Comp. Assoc. Intl.*	$648.8	$264.9	144.9
3	56	Sun Microsystems Inc.	$755.9	$342.7	120.6
4	68	Bell Atlantic Corp.*	$634.9	$310.0	104.8
5	50	Atlantic Comp. plc*	£587.1	£293.1	100.3
6	94	MiniScribe Corp.	$362.5	$184.9	96.0
7	37	Compaq Comp. Corp.	$1,224.1	$625.2	95.8
8	46	Zenith Elec.Corp.	$1,040.0	$548.0	89.8
9	78	Microsoft Corp.	$456.7	$260.2	75.5
10	75	Amstrad plc	£326.0	£186.9	74.4
11	87	Wyse Technology*	$396.2	$228.0	73.8
12	29	Amdahl Corp.	$1,505.2	$966.3	55.8
13	92	Tandon Corp.	$374.0	$242.8	54.0
14	44	Seagate Technology	$1,075.7	$709.4	51.6
15	13	Apple Computer Inc.	$3,041.2	$2,031.0	49.7

■ **Acquisitions in computer leasing propelled Inspecterate, Bell Atlantic, and Atlantic Computers. For Sun, it was sales, sales, and more sales.**

*Companies at which a merger or acquisition occurred.

Falling Fortunes

RANKED BY PERCENT DECLINE IN IS REVENUE

	DTM 100 RANK	COMPANY	IS REV. IN LOCAL CURRENCY (MIL.)		% DECREASE
			1987	1986	
1	118	Plessey Co. plc	£149.0	£200.0	-25.5
2	52	C. Itoh & Co. Ltd.	¥119,924.0	¥136,288.0	-12.0
3	109	Boeing Co.	$266.3	$300.0	-11.2
4	99	Tektronix Inc.	$320.0	$350.0	-8.6
5	97	Dataproducts Corp.	$334.2	$350.8	-4.7
6	23	AT&T Corp.	$2,000.0	$2,085.0	-4.1
7	81	Harris Corp.	$446.0	$464.0	-3.9
8	55	Commodore Intl. Ltd.	$785.0	$800.0	-1.9
9	59	Texas Instruments Inc.	$740.0	$750.0	-1.3
10	98	Datapoint Corp.	$320.7	$325.0	-1.3
11	38	Seiko Epson Corp.	¥173,317.0	¥174,530.0	-0.7
12	15	Control Data Corp.	$3,000.9	$3,004.7	-0.1

■ **Negative growth at Plessey and Boeing knocked them off the DATAMATION 100.**

In the Red

SIX WHO LOST MONEY

	DTM 100 RANK	COMPANY	1987 EARNINGS LOSS ($ MIL.)	1986 EARNINGS LOSS/GAIN ($ MIL.)
1	32	Data General Corp.	111.3	-26.8
2	100	Gould Inc.	95.6	-101.8
3	79	Xidex Corp.	48.9	+32.5
4	90	Convergent Technologies Inc.	32.6	-32.8
5	46	Zenith Electronics Corp.	19.1	-10.0
6	97	Dataproducts Corp.	3.6	+12.8

■ **Only six companies on the DATAMATION 100 lost money in 1987, compared with 12 in 1986. Data General, Gould, Convergent, and Zenith are all appearing for the second year in a row.**

turned in respectable 15% to 16% increases in mainframe sales as measured in yen. In dollars, it was the U.S.-based plug-compatible mainframe makers that carried the day. Amdahl's sales soared 84.3%, and National Advanced Systems' mainframe shipments advanced nearly 21%.

Minicomputer revenues among this year's DATAMATION 100 companies grew 19.4% to $21.7 billion, slightly increasing the midrange share of the total DATAMATION 100 revenues to 10.4%. (Minicomputer revenues for 1986 were restated, reflecting revised estimates for several companies, including IBM, DEC, and Unisys.) Tandem, NCR, and, of course, DEC were the shining lights here, all reporting more than 20% growth in this segment, which includes workstations. NCR's single platform strategy seems to be paying off big for the onetime cash register king. Posting staggering growth was Sun Microsystems, riding hard on the superfast workstation track with mini revenues 121% higher than its 1986 results. Data General sulks in the gloomy depths of this sector. DG was the victim of fierce competition in the commercial systems sector and the biggest money loser on the short 1987 roster of unprofitable companies. Of the mini vendors, only Unisys and Gould reported lower growth in this sector than Data General.

Spotty weakness in the mini market may also presage some shifts in the IS machine strategies pursued by users. There are signs that major users are shifting toward a two-tiered architecture of computing—mainframe to micros—and away from a three-tiered structure—mainframe to minis to micros—according to Frederic G. Withington, an industry consultant and DATAMATION advisor. IBM's lack of success with its 9370 mini, to which customers were supposed to move 370 mainframe applications, supports this theory.

Pcs, Peripherals, and Software Set Pace

Micro revenues for the DATAMATION 100 climbed 19.7% to $23.6 billion, boosting the micro share of the technology pie to 11.3%. (Micro revenues for 1986 were restated, reflecting revised estimates for IBM, Apple, and Unisys.) The top micro growth achievers were Tandon (159%), Amstrad (95%), Compaq (96%), and Zenith (90%). Tandon sold its way back into the DATAMATION 100 ranks, having been absent for two years during its transition from disk drive manufacturer to systems supplier. (Tandon's total IS revenues include those of its discontinued disk drive business.) Apple, number two in micro sales behind IBM, continued to shine, polishing up 55% growth despite some difficulties. Micro sales soured, however, for AT&T and its pc partner, Olivetti, as well as for Commodore and Wang. Micro sales at all four companies fell in 1987.

Peripherals continued to keep pace with the processors whose input and output they produce. Sales of printer, storage, and other peripherals products (including those bundled together with systems sales) grew 20.7% to $53.2 billion in 1987. They represent a quarter of the industry's IS sales—the biggest technology chunk of all. (Peripherals revenues for 1986 were restated, reflecting revised estimates for IBM, DEC, and Control Data.)

Despite such growth, some vendors last year saw a downturn in their peripherals business. IBM experienced a 6% drop—the first such decline in that segment in recent memory. Control Data Corp. had a difficult year, with tough pricing and wrenching product transitions causing trouble in its data storage business. CDC's peripherals sales dropped 9.4% in 1987. At Seagate Technology, however, it was boom time, with revenues up 51.6% and

Top Performers

THE COMPANIES WITH THE HIGHEST RETURN ON SALES

	DTM 100 RANK	COMPANY	1987 % NET RETURN ON SALES	1986 % NET RETURN ON SALES
1	61	Cray Research Inc.	21.4	20.9
2	78	Microsoft Corp.	20.4	22.1
3	88	Lotus Development Corp.	18.2	17.1
4	75	Amstrad plc	17.9	18.6
5	2	Digital Equipment Corp.	12.4	10.2
6	68	Bell Atlantic Corp.	12.0	11.8
7	89	Shared Medical Systems Corp.	11.6	8.5
8	37	Compaq Computer Corp.	11.1	6.8
9	67	Intergraph Corp.	10.9	11.6
10	44	Seagate Technology	10.7	12.7
11	30	ADP Inc.	10.2	8.9
12*	80	3M	9.7	9.1
12*	29	Amdahl Corp.	9.7	4.3
12*	1	IBM	9.7	9.3
15	43	Tandem Computers Inc.	9.4	9.4

■ Cray and Microsoft take top honors for the second year in a row. Compaq and Amdahl upped their performances nicely.

*Before rounding off, the figure for 3M was 9.735; for Amdahl, 9.699; and for IBM, 9.698.

Big Returns

THE COMPANIES WITH THE HIGHEST RETURN ON ASSETS

	DTM 100 RANK	COMPANY	1987 % RETURN ON ASSETS	1986 % RETURN ON ASSETS
1	78	Microsoft Corp.	32.3	33.7
2	88	Lotus Development Corp	22.7	23.1
3	20	STC plc	21.0	19.0
4	13	Apple Computer Inc.	17.3	12.2
5	61	Cray Research Inc.	16.3	21.5
6	74	Racal Electronics plc	16.2	12.5
7	82	Finsiel SpA	15.6	17.1
8	37	Compaq Computer Corp.	15.1	11.3
9	89	Shared Medical Systems Corp.	14.7	10.5
10	2	Digital Equipment Corp.	13.6	10.8
11	25	Tandy Corp.	13.0	9.6
12	44	Seagate Technology	11.7	19.8
13*	80	3M	11.4	10.6
13*	94	MiniScribe Corp.	11.4	16.6
15	31	Electronic Data Systems	10.9	10.8

■ Seagate and Cray both did much better in 1986.

*Before rounding off, the figure for 1987 % return on assets for 3M was 11.43, and for MiniScribe, 11.37.

topping a billion dollars for the first time ever.

Software revenues, not surprisingly, grew the fastest of all technology segments—spurting 29.6% to nearly $17 billion in 1987. Software, including programs bundled together with systems, accounted for 8.1% of total IS revenues last year. (Software revenues for 1986 were restated, reflecting a revised estimate for Unisys.)

The new kid on the software block is Computer Associates. Fortified by its acquistion of Uccel and now a more than half-billion-dollar company, Computer Associates reigns as the largest independent software company in the world. Others achieved success via internal growth, with Microsoft and Lotus serving as notable examples. Software sales were by far the brightest spot on the Big Blue ledger, up 23.9%. In fact, software was responsible for approximately 60% of IBM's profit, not surprising when systems software margins are in the 70% range.

Integration, Connectivity Drive Growth

Services revenues for the DATAMATION 100 last year grew to $15.2 billion, up by 12.7%. They now account for 7.3% of all IS revenues. (Services revenues for 1986 were restated, reflecting revised estimates for Unisys, IBM, Control Data, and Emhart.) The field is dominated by giants, particularly the fearsome quartet of TRW, ADP, EDS, and Computer Sciences. Coming up fast are Arthur Andersen and France's Cap Gemini Sogeti.

Virtually all of the service companies are pressing the same hot button— systems integration. The chairman and president of Computer Sciences Corp., William Hoover, predicts a "20% to 30% annual growth in the systems integration market, resulting in worldwide revenues of more than $15 billion by 1992." IBM, which for years had avoided the field, has now moved entire teams into systems integration—a move some say is inspired by

The Big Hirers

RANKED BY PERCENT ADDITION IN STAFF

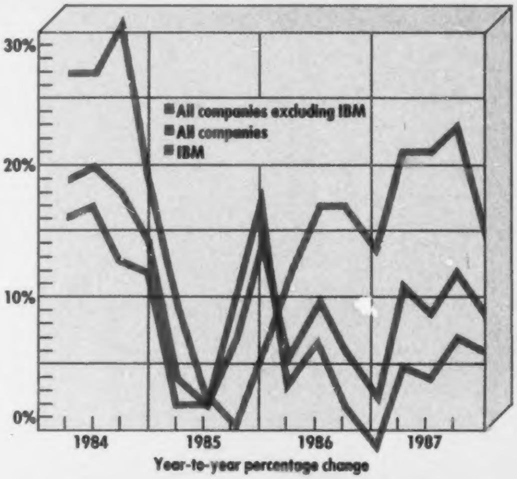
	DTM 100 RANK	COMPANY	1987 EMPLS.	1986 EMPLS.	% INCREASE
1*	87	Wyse Technology	3,600	1,516	137.5
1*	84	Continental IS Corp.	900	379	137.5
3	37	Compaq Computer Corp.	4,000	1,900	110.5
4	44	Seagate Technology	23,490	11,872	97.9
5	75	Amstrad plc	1,009	526	91.8
6	94	MiniScribe Corp.	4,971	2,658	87.0
7	50	Atlantic Computers plc	1,134	630	80.0
8	56	Sun Microsystems Inc.	5,465	3,163	72.8
9	66	Computer Associates Inc.	4,000	2,400	66.7
10	88	Lotus Development Corp.	2,119	1,400	51.4
11	38	Seiko Epson Corp.	17,000	12,000	41.7
12	64	Cap Gemini Sogeti	10,600	7,500	41.3
13	13	Apple Computer Inc.	7,927	5,940	33.5
14	78	Microsoft Corp.	1,996	1,500	33.1
15	90	Convergent Tech. Inc.	3,200	2,483	28.9

■ **Compaq doubled its staff, and Seagate came close, all from internal growth.**

*Wyse Technology and Continental IS Corp. tied for first place.

Quarterly Report

Year-to-year growth for 10 leading companies that sell predominantly computers: IBM, DEC, NCR, Wang, Apple, Amdahl, DG, Tandem, Prime, and Commodore.



■ **Quarter by quarter, the industry had its most consistent year of growth since 1984, although the pace slackened somewhat in the last three months. But for IBM, it's still not like the old days.**

Hearty Workers

RANKED BY IS REVENUE PER EMPLOYEE

	DTM 100 RANK	COMPANY	REVS. PER EMPL. ($ THOU.)	1987 IS REVS. ($ MIL.)	1987 EMPLS.
1	76	Comparex IS GmbH	502.7	530.8	1,056
2	84	Continental IS	450.4	405.4	900
3	65	Econocom Intl. BV	421.4	674.3	1,600
4	13	Apple Computer Inc.	383.7	3,041.2	7,927
5	37	Compaq Computer Corp.	306.0	1,224.1	4,000
6	33	Nippon Univac Kaisha Ltd.	293.6	1,294.6	4,410
7	55	Commodore Intl. Ltd.	249.2	785.0	3,150
8	78	Microsoft Corp.	228.8	456.7	1,996
9	29	Amdahl Corp.	198.1	1,505.2	7,600
10	88	Lotus Development Corp.	186.7	395.6	2,119
11	66	Computer Assoc. Intl. Inc.	162.2	648.8	4,000
12	61	Cray Research Inc.	159.5	687.3	4,308

■ **By this standard, Microsoft has Lotus beat.**

Includes only those companies with at least 95% of revenues from IS.

Shrinking Populations

RANKED BY PERCENT REDUCTION IN STAFF

	DTM 100 RANK	COMPANY	1987 EMPLS.	1986 EMPLS.	% DECREASE
1	98	Datapoint Corp.	2,810	3,621	-22.4
2	53	General Electric Co.	302,000	359,000	-15.9
3	97	Dataproducts Corp.	3,600	4,200	-14.3
4	81	Harris Corp.	23,200	26,700	-13.1
5	85	Emhart Corp.	30,548	34,173	-10.6
6	28	LM Ericsson	70,893	77,575	-8.6
7	95	Diebold Inc.	4,878	5,320	-8.3
8	3	Unisys Corp.	92,500	98,300	-5.9
9	46	Zenith Electronics Corp.	35,000	37,000	-5.4
10	100	Gould Inc.	10,126	10,613	-4.6
11	20	STC plc	33,860	35,420	-4.4
12	31	EDS Corp.	43,433	45,370	-4.3
13	71	Computervision Corp.	4,575	4,770	-4.1
14	1	IBM	389,348	403,508	-3.5
15	15	Control Data Corp.	34,500	35,500	-2.8

■ Some real downsizing took place at GE, IBM, Ericsson, and Unisys.

EDS's success. The consulting arms of Arthur Andersen and the other Big Eight accounting firms have targeted the area as well. Banking on their experience with government contracts, the IS arms of the big aerospace companies also expect to make a bundle with systems integration.

In the age of connectivity, it is no surprise that the data communications sector also scored good growth, up 17.5% to $15.1 billion. (Datacom revenues for 1986 were restated for several companies, including IBM, Matsushita, and Ericsson.) Datacom now accounts for 7.2% of the IS revenues of the DATAMATION 100. Pricing pressures in PBXs kept revenue growth down at both AT&T and Northern Telecom. On the other hand, booming sales of facsimile machines boosted datacom revenues at Canon, Ricoh, and Toshiba. The new player here is Alcatel, making its debut on this year's roster on the strength of combining the IS business of ITT and CGE.

New Arrivals and Some Departures

There are, in fact, several newcomers to this year's DATAMATION 100. Some have arrived on the wings of technology, others at the hands of merger and acquisition specialists. Canon points up the soaring popularity of facsimiles and laser printers. Inspectorate, the leasing giant, now owns the formerly separate leasing companies United (in the U.K.) and Meridian (in the U.S.). Memorex International, which emerged as a public company in 1987 after a management buy-out from Burroughs/Unisys, will appear next year as Memorex Telex NV. Société Générale is a French bank that owns leasing firm Europe Computer Systemes and has interests in software and services businesses. Econocom is a European-based leasing company that operates worldwide.

Other DATAMATION 100 new arrivals include Alps, which exemplifies Japan's peripherals prowess. The previously mentioned British pc maker Amstrad posted almost 75% growth from its sales. Comparex is the West German firm formed from the mainframe operations of BASF and Siemens. Finsiel, Italy's largest software company, was inadvertently overlooked last year because of confusion over how it reported its figures. Wyse, a terminal and IBM-compatible pc company, has grown through smart acquisitions and clever marketing. MiniScribe made it into the top 100 on soaring sales of hard disk drives.

New members of the billion-dollar-plus club in 1987 were Zenith, Seagate, Tandem, Nippon Telegraph and Telephone, Computer Sciences, Oki, Comdisco, Compaq, Ricoh, Nippon Univac Kaisha, Amdahl, and Canon.

Somebody, of course, had to leave the ranks of the DATAMATION 100 to make room for the upstarts. Paradyne Corp. had a tough year that saw revenues from its datacom products fall 11%. Eastman Kodak faced competition in its magnetic media and computer publishing businesses, holding growth to 16%—not quite enough to break the DATAMATION 100 barrier in 1987. Plessey Co. plc, the U.K. firm, saw its IS revenues fall 17%. Boeing's noncaptive IS revenues fell 11.2%. A closer look at Contel Corp.'s IS revenues puts them well off the list. Nomura Computer Systems dropped off because a large component of its IS revenues were discovered to be captive sales to parent Nomura Securities. British Telecom's captive IS sales were also removed from its total. A large piece of AGS Computers' revenues were found to be from simple distribution business.

BASF, CGE, and ITT have left the roster because they no longer operate large IS businesses. BASF's computer operation is now part of Comparex; CGE and ITT's computer/datacom business is now part of newcomer Alcatel. The venerable Honeywell Inc. vanished, its computer business now the province of Honeywell Bull. And No. 100 on last year's list, Recognition Equipment Inc., found that a 7.5% revenue increase wasn't enough to keep up with the pack.

Competition, consolidation, and technology continue to raise the barrier to entry into the DATAMATION 100. Lotus Development's $157 million in IS revenues were good enough to place the micro software company just above the threshhold in our 1985 rankings. It took Thorn EMI $205 million to take the last spot in our 1986 tally. Recognition had to come up with $247 million to make the 1987 list. Gould's $299 million in IS revenues mark the 1988 barrier, so it's reasonable to expect that a company will have to clear $350 million in IS revenues to make next year's DATAMATION 100.

Currency Exchange Rates

Results for non-U.S. companies are converted into dollars using OECD average exchange rates. For those currencies not part of OECD, exchange rate information was provided by the International Monetary Fund. For 1987, equivalents to $1 in these currencies were as follows: European Currency Unit, ECU.87; Finland, Fmk4.40; France, FF6.01; Italy, L1,296.97; Japan, ¥144.62; the Netherlands, G2.03; Norway, NKr6.74; Sweden, Skr6.34; Switzerland, SFr1.50; Taiwan, TD31.76; the U.K., £.61; West Germany, DM1.80; South Korea, W822.57.

For 1986, equivalents to $1 in these currencies were as follows: European Currency Unit, ECU1.02; Finland, Fmk5.07; France, FF6.93; Italy, L1,491.05; Japan, ¥168.52; the Netherlands, G2.45; Norway, NKr7.39; Sweden, Skr7.12; Taiwan, TD37.84; the U.K. £.68; West Germany, DM2.17; South Korea, W881.45.

DATAMATION would like to thank the following for providing information used in the DATAMATION 100: Daratech Inc., Cambridge, Mass.; Dataquest, San Jose; First Boston Corp., New York; Future Computing Inc., Richardson, Texas; Merrill Lynch, New York; Northern Business Information, New York; Sanford C. Bernstein & Co., New York; Santa Clara Consulting Group, Santa Clara; and Smith Barney, Harris Upham & Co., New York.

BY PARKER HODGES

The DATAMATION 100 - The Leading Worldwide IS Companies

1987 Rank	COMPANY	1987 IS REVENUE
1	IBM	$50,485.7
2	Digital Equipment Corp.	10,391.3
3	Unisys Corp.	8,742.0
4	Fujitsu Ltd.	8,740.0
5	NEC Corp.	8,230.5
6	Hitachi Ltd.	6,273.7
7	Siemens AG	5,703.0
8	NCR Corp.	5,075.7
9	Hewlett-Packard Co.	5,000.0
10	Ing. C. Olivetti & Co. SpA	4,637.2
11	Toshiba Corp.	3,441.3
12	Wang Laboratories Inc.	3,045.7
13	Apple Computer Inc.	3,041.2
14	Groupe Bull	3,007.5
15	Control Data Corp.	3,000.9
16	Nixdorf Computer AG	2,821.5
17	Matsushita Electric Indust. Co.	2,628.5
18	NV Philips Gloeilampenfabrieken	2,601.6
19	Xerox Corp.	2,415.0
20	STC plc	2,123.9
21	Honeywell Bull Inc.	2,059.0
22	Alcatel NV	2,052.1
23	AT&T Corp.	2,000.0
24	TRW Inc.	1,960.0
25	Tandy Corp.	1,692.4
26	Mitsubishi Electric Corp.	1,673.9
27	Canon Inc.	1,673.4
28	LM Ericsson	1,511.6
29	Amdahl Corp.	1,505.2
30	Automatic Data Processing inc.	1,467.0
31	Electronic Data Systems	1,440.5
32	Data General Corp.	1,303.9
33	Nippon Univac Kaisha Ltd.	1,294.6
34	Ricoh Co. Ltd.	1,275.7
35	McDonnell Douglas Corp.	1,241.8
36	Inspectorate International Ltd.	1,225.0
37	Compaq Computer Corp.	1,224.1
38	Seiko Epson Corp.	1,198.4
39	Comdisco Inc.	1,153.0
40	Oki Electric Industry Co. Ltd.	1,137.3
41	Computer Sciences Corp.	1,133.8
42	Nippon Telegraph & Telephone Corp.	1,128.5
43	Tandem Computers Inc.	1,089.6
44	Seagate Technology	1,075.7
45	Memorex International	1,041.1
46	Zenith Electronics Corp.	1,040.0
47	National Semiconductor Corp.	985.0
48	Société Générale	970.1
49	Prime Computer Inc.	960.9
50	Atlantic Computers plc	959.7
51	Northern Telecom Ltd.	900.0
52	C. Itoh & Co. Ltd.	829.2
53	General Electric Co.	800.0
54	Telex Corp.	788.9
55	Commodore International Ltd.	785.0
56	Sun Microsystems Inc.	755.9
57	Storage Technology Corp.	750.0
58	Arthur Andersen & Co.	748.9
59	Texas Instruments Inc.	740.0
60	Motorola Inc.	724.9
61	Cray Research Inc.	687.3
62	Mannesmann AG	686.0
63	Martin Marietta Corp.	685.7
64	Cap Gemini Sogeti	682.3
65	Econocom International BV	674.3
66	Computer Associates International Inc.	648.8
67	Intergraph Corp.	641.1
68	Bell Atlantic Corp.	634.9
69	Alps Electric Co. Ltd.	632.5
70	Samsung Electronics Co. Ltd.	569.5
71	Computervision Corp.	564.0
72	Apollo Computer Inc.	553.6
73	Lockheed Corp.	553.0
74	Racal Electronics plc	549.1
75	Amstrad plc	533.0
76	Comparex Information Systeme GmbH	530.8
77	CSK Group	486.9
78	Microsoft Corp.	456.7
79	Xidex Corp.	455.7
80	3M	455.0
81	Harris Corp.	446.0
82	Finsiel SpA	424.1
83	Norsk Data AS	422.6
84	Continental Information Systems Corp.	405.4
85	Emhart Corp.	404.8
86	Ferranti plc	398.8
87	Wyse Technology	396.2
88	Lotus Development Corp.	395.6
89	Shared Medical Systems Corp.	390.7
90	Convergent Technologies Inc.	384.8
91	Nokia Corp.	375.3
92	Tandon Corp.	374.0
93	Sony Corp.	365.5
94	MiniScribe Corp.	362.5
95	Diebold Inc.	345.5
96	MAI Basic Four Inc.	334.2
96	Dataproducts Corp.	334.2
98	Datapoint Corp.	320.7
99	Tektronix Inc.	320.0
100	Gould Inc.	299.3

Revenue figures are in millions of dollars.

The 100 Leading U.S. IS Companies

1987 US RANK	1987 WORLD RANK	1986 WORLD RANK	COMPANY	1987 IS REVENUE	1986 IS REVENUE	IS REV % CHANGE	1987 TOTAL REVENUE
1	1	1	IBM	50,485.7	47,685.0	5.9	54,217.0
2	2	3	Digital Equipment Corp.	10,391.3	8,414.3	23.5	10,391.3
3	3	2	Unisys Corp.	8,742.0	8,186.0	6.8	9,712.9
4	8	9	NCR Corp.	5,075.7	4,386.6	15.7	5,640.7
5	9	7	Hewlett-Packard Co.	5,000.0	4,500.0	11.1	8,090.0
6	12	12	Wang Laboratories Inc.	3,045.7	2,668.9	14.1	3,045.7
7	13	18	Apple Computer Inc.	3,041.2	2,031.0	49.7	3,041.2
8	15	11	Control Data Corp.	3,000.9	3,004.7	-0.1	3,366.5
9	19	15	Xerox Corp.	2,415.0	2,100.0	15.0	14,895.0
10	21	—	Honeywell Bull Inc.	2,059.0	1,890.0	8.9	2,059.0
11	23	16	AT&T Corp.	2,000.0	2,085.0	-4.1	33,598.0
12	24	23	TRW Inc.	1,960.0	1,625.0	20.6	6,821.2
13	25	24	Tandy Corp.	1,692.4	1,560.2	8.5	3,654.7
14	29	36	Amdahl Corp.	1,505.2	966.3	55.8	1,505.2
15	30	27	Automatic Data Processing Inc.	1,467.0	1,298.1	13.0	1,467.0
16	31	31	Electronic Data Systems	1,440.5	1,125.9	27.9	4,435.9
17	32	28	Data General Corp.	1,303.9	1,287.6	1.3	1,303.9
18	35	29	McDonnell Douglas Corp.	1,241.8	1,189.8	4.4	13,344.5
19	37	54	Compaq Computer Corp.	1,224.1	625.2	95.8	1,224.1
20	39	40	Comdisco Inc.	1,153.0	985.0	17.1	1,234.0
21	41	35	Computer Sciences Corp.	1,133.8	977.7	16.0	1,133.8
22	43	44	Tandem Computers Inc.	1,089.6	845.3	28.9	1,089.6
23	44	50	Seagate Technology	1,075.7	709.4	51.6	1,075.7
24	46	58	Zenith Electronics Corp.	1,040.0	548.0	89.9	2,363.0
25	47	49	National Semiconductor Corp.	985.0	725.0	35.9	2,067.6
26	49	43	Prime Computer Inc.	960.9	860.2	11.7	960.9
27	53	38	General Electric Co.	800.0	800.0	0.0	40,515.0
28	54	48	Telex Corp.	788.9	728.2	8.3	877.8
29	55	46	Commodore International Ltd.	785.0	800.0	-1.9	815.5
30	56	76	Sun Microsystems Inc.	755.9	342.7	120.6	755.9
31	57	51	Storage Technology Corp.	750.0	696.0	7.8	750.0
32	58	59	Arthur Andersen & Co.	748.9	546.0	37.2	2,481.9
33	59	47	Texas Instruments Inc.	740.0	750.0	-1.3	5,594.5
34	60	52	Motorola Inc.	724.9	694.0	4.4	6,707.0
35	61	56	Cray Research Inc.	687.3	596.7	15.2	687.3
36	63	53	Martin Marietta Corp.	685.7	659.4	4.0	5,418.3
37	66	93	Computer Associates International Inc.	648.8	264.9	144.9	648.8
38	67	55	Intergraph Corp.	641.1	605.7	5.8	641.1
39	68	81	Bell Atlantic Corp.	634.9	310.0	104.8	10,298.4
40	71	61	Computervision Corp.	564.0	494.7	14.0	564.0
41	72	69	Apollo Computer Inc.	553.6	391.7	41.3	553.6
42	73	57	Lockheed Corp.	553.0	497.0	11.3	11,321.0
43	78	96	Microsoft Corp.	456.7	260.2	75.5	456.7
44	79	67	Xidex Corp.	455.7	418.3	8.9	599.6
45	80	97	3M	455.0	400.0	13.7	9,429.0
46	81	64	Harris Corp.	446.0	464.0	-3.9	2,083.9
47	84	90	Continental Information Systems Corp.	405.4	282.9	43.3	420.8
48	85	99	Emhart Corp.	404.8	356.0	13.7	2,454.5
49	87	108	Wyse Technology	396.2	228.0	73.8	396.2
50	88	89	Lotus Development Corp.	395.6	283.0	39.9	395.6

All currency figures are in millions. NA = not available.

				R&D					
IS AS % OF TOTAL	1987 EMPLS	% CHANGE FROM 1986	IS REV PER EMPL* ($ THOU)	CORP 1987	AS % OF TOTAL REV	NET INCOME	% RETURN ON ASSETS	FISCAL YEAR END	LOCATION
93.1	389,384	(3.5)	139.2†	5,434.0	10.0	5,258.0	8.3	Dec.	N.Y.
100.0	116,800	15.6	89.0	1,138.8	11.0	1,284.3	13.6	June	Mass.
90.0	92,500	(5.9)	105.0†	1,318.5	13.6	578.0	5.8	Dec.	Mich.
90.0	62,000	0.0	91.0†	355.9	6.3	419.3	10.0	Dec.	Ohio
61.8	82,000	0.0	98.7†	901.0	11.1	644.0	7.9	Oct.	Calif.
100.0	30,855	(.5)	98.7	232.0	7.6	94.5	3.4	June	Mass.
100.0	7,927	33.5	383.7	203.3	6.7	280.5	17.3	Sept.	Calif.
89.1	34,500	(2.8)	97.6†	389.0	11.6	19.3	.7	Dec.	Minn.
16.2	99,032	(1.3)	150.4†	722.0	4.9	578.0	5.0	Dec.	Conn.
100.0	20,500	(6.8)	100.4	216.0	10.5	17.4	NA	Dec.	Minn.
6.0	303,000	(2.6)	110.9†	2,453.0	7.3	2,044.0	5.3	Dec.	N.Y.
28.7	77,931	(.9)	87.5†	1,874.0	27.5	243.4	5.6	Dec.	Ohio
46.3	36,000	0.0	101.5†	NA	NA	289.8	13.0	June	Texas
100.0	7,600	5.6	198.1	178.9	11.9	146.0	9.7	Dec.	Calif.
100.0	22,000	10.0	66.7	59.6	4.1	149.8	9.4	June	N.J.
100.0	43,433	(4.3)	102.1†	NA	NA	323.1	10.9	Dec.	Texas
100.0	15,640	(.4)	83.4	164.7	12.6	-111.3	—	Sept.	Mass.
9.3	112,400	6.3	118.7†	647.7	4.9	313.0	3.7	Dec.	Mo.
100.0	4,000	110.5	306.0	47.1	3.9	136.0	15.1	Dec.	Texas
93.4	1,130	21.5	1,092.4	NA	NA	23.0	.8	Sept.	Ill.
100.0	18,400	6.4	61.6	NA	NA	40.5	6.5	March	Calif.
100.0	7,176	19.2	151.8	120.8	11.1	101.9	9.6	Sept.	Calif.
100.0	23,490	97.9	45.8	40.9	3.8	115.3	11.7	June	Calif.
44.0	35,000	(5.4)	67.5†	103.4	4.4	-19.1	—	Dec.	Ill.
47.6	38,000	23.4	54.4†	220.0	10.6	6.6	.4	May	Calif.
100.0	8,818	2.3	109.0	109.7	11.4	64.8	4.9	Dec.	Mass.
2.0	302,000	15.9	134.2†	1,194.0	3.0	2,915.0	4.7	Dec.	Conn.
89.9	8,289	5.6	105.9†	50.8	5.8	56.6	8.6	March	Okla.
96.3	3,150	(.8)	249.2	16.5	2.0	37.1	6.4	June	Pa.
100.0	5,465	72.8	138.3	101.5	13.4	48.0	7.5	June	Calif.
100.0	8,865	(5.5)	84.6	60.0	8.0	26.0	3.3	Dec.	Colo.
30.2	40,000	10.7	62.0†	NA	NA	NA	NA	Aug.	Ill.
13.2	77,984	.9	71.7†	428.0	7.7	308.5	7.3	Dec.	Texas
10.8	97,700	3.5	68.6†	524.0	7.8	308.0	5.8	Dec.	Ill.
100.0	4,308	7.7	159.5	108.8	15.8	147.1	16.3	Dec.	Minn.
12.7	68,000	3.3	79.6†	220.0	4.1	230.6	8.2	Dec.	Md.
100.0	4,000	66.7	162.2	81.1	12.5	60.2	7.7	March	N.Y.
100.0	6,300	11.5	101.8	67.5	10.5	69.9	9.9	Dec.	Ala.
6.2	80,950	.9	127.2†	NA	NA	1,240.4	5.8	Dec.	Pa.
100.0	4,575	(4.1)	123.3	60.1	10.7	19.5	4.0	Dec.	Mass.
100.0	3,992	10.9	138.7	61.1	11.0	21.7	4.9	Dec.	Mass.
4.9	99,300	2.5	114.0†	549.0	4.8	421.0	7.0	Dec.	Calif.
100.0	1,996	33.1	228.8	50.1	11.0	93.0	32.3	June	Wash.
76.0	7,299	12.3	82.1†	10.7	1.8	-48.9	—	June	Calif.
4.8	82,405	.5	114.4†	618.0	6.5	918.0	11.4	Dec.	Minn.
21.4	23,200	(13.1)	89.8	117.7	5.6	92.2	5.4	June	Fla.
96.3	900	137.5	450.4	NA	NA	15.1	.8	Feb.	N.Y.
16.5	30,548	(10.6)	80.3†	39.8	1.6	106.5	5.2	Dec.	Conn.
100.0	3,600	137.5	110.1	21.1	5.3	25.5	6.8	March	Calif.
100.0	2,119	51.4	186.7	58.4	14.8	72.0	22.7	Dec.	Mass.

*For companies with more than 95% of revenues from IS.

†Based on total corporate revenues.

The 100 Leading U.S. IS Companies

1987 US RANK	1987 WORLD RANK	1986 WORLD RANK	COMPANY	1987 IS REVENUE	1986 IS REVENUE	IS REV % CHANGE	1987 TOTAL REVENUE
51	89	71	Shared Medical Systems Corp.	390.7	374.9	4.2	390.7
52	90	83	Convergent Technologies Inc.	384.8	305.8	25.8	384.8
53	92	106	Tandon Corp.	374.0	242.8	54.0	374.0
54	94	125	MiniScribe Corp.	362.5	184.9	96.0	362.5
55	95	78	Diebold Inc.	345.5	325.5	6.1	439.1
56	96	87	MAI Basic Four Inc.	334.2	287.9	16.1	334.2
56	97	73	Dataproducts Corp.	334.2	350.8	-4.7	334.2
58	98	79	Datapoint Corp.	320.7	325.0	-1.3	320.7
59	99	74	Tektronix Inc.	320.0	350.0	-8.6	1,388.9
60	100	86	Gould Inc.	299.3	290.0	3.2	933.4
61	102	98	Eastman Kodak Co.	290.0	250.0	16.0	13,305.0
62	103	133	AST Research Inc.	289.8	168.9	71.6	289.8
63	104	110	Micropolis Corp.	288.3	213.1	35.3	288.3
64	106	158	Genicom Corp.	284.9	133.8	112.9	302.5
65	108	112	Ashton-Tate	267.3	210.7	26.9	267.3
66	109	84	Boeing Co.	266.3	300.0	-11.2	15,355.0
67	110	109	Concurrent Computer Corp.	265.3	227.7	16.5	265.3
68	111	100	Recognition Equipment Inc.	265.2	246.6	7.5	265.2
69	112	120	Management Science America Inc.	258.5	193.5	33.6	258.5
70	114	111	Gerber Scientific Inc.	254.8	213.1	19.6	254.8
71	116	116	Atari	250.0	200.0	25.0	493.2
72	119	107	Schlumberger Ltd.	240.0	240.0	0.0	4,727.0
73	120	147	Maxtor Corp.	239.4	148.0	61.8	239.4
74	121	114	Reynolds & Reynolds Co.	237.9	204.3	16.4	572.1
75	123	95	Paradyne Corp.	232.6	261.1	-10.9	232.6
76	125	129	Bolt Beranek and Newman Inc.	223.1	172.5	29.3	279.8
77	126	128	Mentor Graphics Corp.	221.8	173.5	27.8	221.8
78	127	117	Intel Corp.	220.0	200.0	10.0	1,907.1
79	130	121	Micom Systems Inc.	212.5	192.5	10.4	212.5
80	131	131	AGS Computers Inc.	212.3	171.0	24.1	496.7
81	132	178	Everex Systems Inc.	210.1	106.4	97.5	210.1
82	133	134	Cullinet Software Inc.	203.9	166.9	22.2	203.9
83	134	126	Software AG Systems Inc.	203.0	180.0	12.8	203.0
84	135	194	Novell Inc.	202.1	113.6	77.9	202.1
85	136	137	Digital Communications	200.6	162.2	23.7	200.6
86	137	115	Dun & Bradstreet Corp.	200.0	200.0	0.0	3,359.2
86	138	156	Price Waterhouse	200.0	135.0	48.1	1,804.0
88	139	185	Oracle Corp.	198.0	88.0	125.0	198.0
89	140	141	The Ultimate Corp.	197.7	157.6	25.4	197.7
89	141	122	General DataComm Industries Inc.	197.7	189.2	4.5	197.7
91	142	192	3Com Corp.	197.5	121.1	63.1	197.5
92	144	113	Sterling Software Inc.	196.9	209.6	-6.1	196.9
93	147	119	Decision Data Computer Corp.	191.4	195.1	-1.9	191.4
94	148	166	Stratus Computer Inc.	184.1	124.6	47.7	184.1
95	149	135	ISC Systems Corp.	181.4	162.4	11.7	181.4
96	150	145	Policy Management Systems Corp.	180.0	151.0	19.2	180.0
97	151	169	Quantum Corp.	178.3	116.5	53.0	178.3
98	152	142	HBO & Co.	175.2	155.0	13.0	175.2
99	153	193	Touche Ross	175.0	NA	NA	1,450.0
100	154	155	American Management Systems Inc.	174.3	135.5	28.6	174.3

All currency figures are in millions. NA = not available.

				R&D					
IS AS % OF TOTAL	1987 EMPLS	% CHANGE FROM 1986	IS REV PER EMPL* ($ THOU)	CORP 1987	AS % OF TOTAL REV	NET INCOME	% RETURN ON ASSETS	FISCAL YEAR END	LOCATION
100.0	4,300	16.2	90.9	37.9	9.7	45.3	14.7	Dec.	Pa.
100.0	3,200	28.9	120.3	33.6	8.7	-32.6	—	Dec.	Calif.
100.0	2,800	21.7	133.6	17.5	4.7	10.3	5.6	Dec.	Calif.
100.0	4,971	87.0	72.9	19.8	5.5	31.1	11.4	Dec.	Colo.
78.7	4,878	(8.3)	90.0†	21.9	5.0	35.8	8.1	Dec.	Ohio
100.0	3,367	11.8	99.3	22.9	6.8	23.9	10.1	Sept.	Calif.
100.0	3,600	(14.3)	92.8	25.6	7.7	-3.6	—	March	Calif.
100.0	2,810	(22.4)	114.1	10.5	3.3	15.3	3.8	July	Texas
23.0	16,879	(2.7)	82.3†	207.5	14.9	25.7	2.6	May	Ore.
32.1	10,126	(4.6)	92.2†	94.3	10.1	-95.6	—	Dec.	Ill.
2.2	124,400	2.4	107.0†	992.0	7.5	1,178.0	8.1	Dec.	N.Y.
100.0	1,525	90.6	190.0	13.5	4.7	8.3	4.8	June	Calif.
100.0	2,385	46.9	120.9	21.8	7.7	27.3	10.4	Dec.	Calif.
94.2	3,600	44.0	84.0†	14.9	4.9	12.6	5.5	Dec.	Va.
100.0	1,200	20.0	222.8	28.0	10.5	43.1	17.4	Jan.	Calif.
1.7	136,100	18.3	112.8†	824.0	5.4	480.0	3.8	Dec.	Wash.
100.0	2,789	(3.0)	95.1	28.8	10.9	12.9	4.9	July	N.J.
100.0	2,859	(1.6)	92.8	11.2	4.2	11.8	4.4	Oct.	Texas
100.0	2,700	2.2	95.7	51.4	19.9	-71.0	—	Dec.	Ga.
100.0	1,850	8.8	137.7	17.7	7.0	28.0	11.8	April	Conn.
50.7	3,850	208.0	128.1†	18.0	3.7	57.4	11.0	Dec.	Calif.
5.1	50,000	0.0	94.5	351.8	7.4	282.6	4.2	Dec.	N.Y.
100.0	2,500	64.0	95.8	20.1	8.4	16.1	5.9	March	Calif.
41.6	5,704	5.1	100.3†	NA	NA	28.0	7.0	Sept.	Ohio
100.0	3,115	3.8	74.7	19.0	8.2	-2.6	—	Dec.	Fla.
79.7	2,850	14.9	98.2†	19.0	6.8	-6.1	—	June	Mass.
100.0	1,200	32.0	184.8	24.4	10.9	20.3	8.9	Dec.	Ore.
11.5	19,200	2.7	99.3†	259.8	13.6	248.1	9.6	Dec.	Calif.
100.0	2,159	2.2	98.4	23.9	11.3	6.8	3.2	March	Calif.
42.7	3,439	11.3	144.4†	12.7	2.6	14.2	6.4	Dec.	N.J.
100.0	1,300	188.9	161.6	12.6	6.0	10.2	9.4	July	Calif.
100.0	2,427	35.1	84.0	53.5	26.2	-23.3	—	April	Mass.
100.0	1,800	2.9	112.8	50.0	24.6	20.0	8.7	May	Va.
100.0	1,240	93.7	163.0	11.1	5.5	21.5	15.4	Oct.	Utah
100.0	1,307	23.8	153.5	24.3	12.1	34.3	16.0	June	Ga.
6.0	60,000	3.5	55.9†	NA	NA	393.0	11.8	Dec.	N.Y.
11.1	35,100	7.0	51.4†	NA	NA	NA	NA	June	N.Y.
100.0	1,597	106.1	124.0	23.2	11.7	29.7	16.0	May	Calif.
100.0	710	67.5	278.5	2.0	1.0	16.7	8.7	April	N.J.
100.0	2,623	.7	75.4	25.8	13.0	-8.3	—	Sept.	Conn.
100.0	1,115	119.9	177.1	17.8	9.0	18.0	10.4	May	Calif.
100.0	2,300	(8.0)	85.6	17.3	8.8	5.9	2.7	Sept.	Texas
100.0	1,545	(3.5)	123.9	10.9	5.7	-23.3	—	Nov.	Pa.
100.0	1,224	14.5	150.4	18.9	10.3	19.4	13.3	Dec.	Mass.
100.0	1,800	0.0	100.8	14.6	8.0	8.1	5.6	June	Wash.
100.0	2,577	1.1	69.8	30.7	17.1	17.1	6.1	Dec.	S.C.
100.0	590	(9.8)	302.2	11.4	6.4	8.1	5.2	March	Calif.
100.0	1,772	1.2	98.9	13.0	7.4	13.3	13.1	Dec.	Ga.
12.1	30,000	0.0	48.3†	NA	NA	NA	NA	Aug.	N.Y.
100.0	2,300	37.3	75.8	6.3	3.6	7.6	9.2	Dec.	Va.

*For companies with more than 95% of revenues from IS.

†Based on total corporate revenues.

The 50 Leading Non-U.S. IS Companies

1987 NON-US RANK	1987 WORLD RANK	1986 WORLD RANK	COMPANY	1987 IS REVENUE	1986 IS REVENUE	IS REV % CHANGE	1987 TOTAL REVENUE	IS AS % OF TOTAL
1	4	4	**Fujitsu Ltd.**	8,740.0	6,575.7	32.9	13,103.2	66.7
2	5	5	**NEC Corp.**	8,230.5	6,324.6	30.1	18,236.8	45.1
3	6	6	**Hitachi Ltd.**	6,273.7	4,728.8	32.7	33,070.6	19.0
4	7	8	**Siemens AG**	5,703.0	4,383.3	30.1	28,615.7	19.9
5	10	10	**Ing. C. Olivetti & Co. SpA**	4,637.2	3,869.1	19.8	5,686.7	81.5
6	11	13	**Toshiba Corp.**	3,441.4	2,605.0	32.1	23,829.0	14.4
7	14	14	**Groupe Bull**	3,007.5	2,569.1	17.1	3,007.5	100.0
8	16	17	**Nixdorf Computer AG**	2,821.5	2,073.3	36.1	2,821.5	100.0
9	17	19	**Matsushita Electric Indust. Co.**	2,628.5	1,972.1	33.3	31,906.1	8.2
10	18	21	**NV Philips Gloeilampenfabrieken**	2,601.6	1,967.6	32.2	26,023.1	10.0
11	20	22	**STC plc**	2,123.9	1,750.8	21.3	3,379.0	62.9
12	22	—	**Alcatel NV**	2,052.1	1,697.4	20.9	12,909.8	15.9
13	26	25	**Mitsubishi Electric Corp.**	1,673.9	1,345.0	24.4	14,947.2	11.2
14	27	—	**Canon Inc.**	1,673.4	994.1	68.3	6,753.5	24.8
15	28	26	**LM Ericsson**	1,511.6	1,343.6	12.5	5,110.2	29.6
16	33	34	**Nippon Univac Kaisha Ltd.**	1,294.6	985.9	31.3	1,294.6	100.0
17	34	37	**Ricoh Co. Ltd.**	1,275.7	933.8	36.6	4,394.9	29.0
18	36	—	**Inspectorate International Ltd.**	1,225.0	266.8	359.1	1,665.5	73.6
19	38	32	**Seiko Epson Corp.**	1,198.4	1,035.7	15.7	2,164.3	55.4
20	40	42	**Oki Electric Industry Co. Ltd.**	1,137.3	880.6	29.1	3,193.5	35.6
21	42	30	**Nippon Telegraph & Telephone Corp.**	1,128.5	905.2	24.7	38,112.6	3.0
22	45	—	**Memorex International**	1,041.1	NA	NA	1,041.1	100.0
23	48	—	**Société Générale**	970.1	567.9	70.8	4,767.6	20.3
24	50	65	**Atlantic Computers plc**	959.9	429.7	123.4	1,031.2	93.1
25	51	38	**Northern Telecom Ltd.**	900.0	900.0	0.0	4,853.5	18.5
26	52	45	**C. Itoh & Co. Ltd.**	829.2	808.7	2.5	105,382.4	0.8
27	62	62	**Mannesmann AG**	686.0	488.5	40.4	823.5	83.3
28	64	66	**Cap Gemini Sogeti**	682.3	420.1	62.4	682.3	100.0
29	65	—	**Econocom International BV**	674.3	435.2	54.9	674.3	100.0
30	69	—	**Alps Electric Co. Ltd.**	632.5	NA	NA	2,635.6	24.0
31	70	68	**Samsung Electronics Co. Ltd.**	569.5	395.1	44.1	4,117.9	13.8
32	74	63	**Racal Electronics plc**	549.1	472.8	16.1	2,178.1	25.2
33	75	—	**Amstrad plc**	533.0	274.0	94.5	965.3	55.2
34	76	—	**Comparex Information Systeme GmbH**	530.8	NA	NA	530.8	100.0
35	77	82	**CSK Group**	486.9	308.7	57.7	802.1	60.7
36	82	—	**Finsiel SpA**	424.1	304.1	39.5	424.1	100.0
37	83	75	**Norsk Data AS**	422.6	349.0	21.1	422.6	100.0
38	86	72	**Ferranti plc**	398.8	335.7	18.8	1,068.8	37.3
39	91	91	**Nokia Corp.**	375.3	273.4	37.3	3,181.7	11.8
40	93	88	**Sony Corp.**	365.5	285.2	28.2	9,470.6	3.9
41	101	—	**Acer Group**	294.0	147.0	100.0	319.0	92.2
42	105	—	**Scicon International Ltd.**	287.0	250.7	14.5	287.0	100.0
43	107	—	**Kyocera Corp.**	281.6	0.0	NA	2,085.1	13.5
44	113	140	**Nomura Computer Systems Co. Ltd.**	257.5	158.1	62.9	377.1	68.3
45	115	—	**Intec**	253.8	NA	NA	253.8	100.0
46	117	118	**Thorn EMI plc**	246.1	199.4	23.4	5,207.7	4.7
47	118	85	**Plessey Co. plc**	243.6	293.2	-16.9	2,107.6	11.6
48	122	—	**Mitac Corp.**	235.0	NA	NA	235.0	100.0
49	124	123	**GSI**	230.5	187.7	22.8	230.5	100.0
50	128	—	**GoldStar Co.**	212.7	NA	NA	NA	NA

All currency figures are in millions. NA = not available.

NONDOLLAR ACCTG CURRENCY					R&D			
1987 IS	1986 IS	% CHANGE	COUNTRY	1987 EMPLS	CORP 1987	AS % OF TOT REV	NET INCOME	FISCAL YEAR END
¥1 263,992.0	¥1,108,134.0	14.1	Japan	89,293	1,154.7	8.8	171.0	March
¥1,190,314.0	¥1,065,820.0	11.7	Japan	101,227	1,711.4	9.4	208.0	March
¥907,315.0	¥796,899.0	13.9	Japan	161,325	2,179.3	6.6	734.5	March
DM10,250.0	DM9,520.0	7.7	W.Ger.	359,000	3,455.7	12.1	709.4	Sept.
L6,014,300.0	L5,769,000.0	4.3	Italy	58,087	330.6	5.8	310.0	Dec.
¥497,700.0	¥439,000.0	13.4	Japan	124,000	1,514.3	6.4	293.6	March
FF18,071.2	FF17,796.0	1.5	France	26,337	332.9	11.1	37.5	Dec.
DM5,071.0	DM4,503.0	12.6	W.Ger.	29,440	265.4	9.4	146.9	Dec.
¥380,145.0	¥332,340.0	14.4	Japan	132,851	1,832.4	5.7	1,010.7	Nov.
G5,270.0	G4,820.0	9.3	Neth.	336,700	2,154.3	8.3	403.8	Dec.
£1,299.0	£1,194.2	8.8	U.K.	33,860	287.8	8.5	221.1	Dec.
ECU1,780.0	ECU1,730.0	2.9	Belgium	137,000	861.2	6.7	398.9	Dec.
¥242,077.0	¥226,654.0	6.8	Japan	70,935	815.9	5.5	131.4	March
¥242,014.0	¥167,519.0	44.5	Japan	NA	449.4	6.6	91.6	March
Skr9,584.0	Skr9,571.0	0.1	Sweden	70,893	505.3	9.9	115.9	Dec.
¥187,227.0	¥166,138.0	12.7	Japan	4,410	NA	NA	20.1	March
¥184,490.0	¥157,357.0	17.2	Japan	15,000	273.6	6.2	92.3	March
SFr1,835.3	SFr182.0	908.4	Switz.	7,698	NA	NA	57.2	Dec.
¥173,317.0	¥174,530.0	-0.7	Japan	17,000	194.8	9.0	NA	March
¥164,481.0	¥148,404.0	10.8	Japan	18,328	178.0	5.6	31.4	March
¥163,201.0	¥152,544.0	7.0	Japan	298,000	NA	NA	1,332.2	March
G2,108.9	NA	NA	Neth.	14,106	51.0	4.9	47.0	Nov.
FF5,829.0	FF3,934.0	48.2	France	NA	NA	NA	NA	Dec.
£587.1	£293.1	100.3	U.K.	1,134	3.3	0.3	42.3	Dec.
—	—	—	Canada	48,778	587.5	12.1	328.8	Dec.
¥119,924.0	¥136,288.0	-12.0	Japan	10,800	NA	NA	138.8	March
DM1,233.0	DM1,061.0	16.2	W.Ger.	9,457	NA	NA	NA	Dec.
FF4,100.0	FF2,910.0	40.9	France	10,600	34.1	5.0	44.3	Dec.
G1,366.0	G1,066.0	28.1	Neth.	1,600	NA	NA	NA	Dec.
¥91,478.0	NA	NA	Japan	NA	NA	NA	NA	March
W468,435.0	W348,300.0	34.5	S.Korea	44,316	245.9	6.0	74.6	Dec.
£335.8	£322.5	4.1	U.K.	32,000	160.2	7.4	193.9	March
£326.0	£186.9	74.4	U.K.	1,009	NA	NA	172.7	June
DM954.0	NA	NA	W.Ger.	1,056	NA	NA	22.4	Dec.
¥70,423.0	¥52,016.0	35.4	Japan	NA	NA	NA	NA	Sept.
L550,000.0	L453,428.0	21.3	Italy	4,060	23.2	5.5	13.2	Dec.
NKr2,847.0	NKr2,580.0	10.3	Norway	4,488	43.0	10.2	29.4	Dec.
L243.9	L229.0	6.5	Italy	24,000	NA	NA	90.6	March
Fmk1,650.0	Fmk1,386.0	19.0	Finland	29,300	145.1	4.6	278.6	Dec.
¥52,859.0	¥48,054.0	10.0	Japan	51,000	852.4	9.0	251.3	Oct.
TD9,336.3	TD5,562.0	67.9	Taiwan	3,795	10.0	3.1	NA	Dec.
£175.5	£171.0	2.6	U.K.	3,800	8.0	2.8	NA	Dec.
¥40,728.8	NA	NA	Japan	NA	NA	NA	NA	March
¥37,234.0	¥26,643.0	39.8	Japan	1,200	NA	NA	NA	Sept.
¥36,702.0	NA	NA	Japan	NA	NA	NA	NA	March
£150.5	£136.0	10.7	U.K.	65,000	87.6	1.7	162.9	March
£149.0	£200.0	-25.5	U.K.	NA	NA	NA	NA	March
TD7,462.7	NA	NA	Taiwan	NA	NA	NA	NA	Dec.
FF1,385.0	FF1,300.0	6.5	France	2,185	11.8	5.1	NA	Dec.
W175,000.0	NA	NA	S.Korea	NA	NA	NA	NA	Dec.

THE
DATAMATION
100
DL

Company Profiles

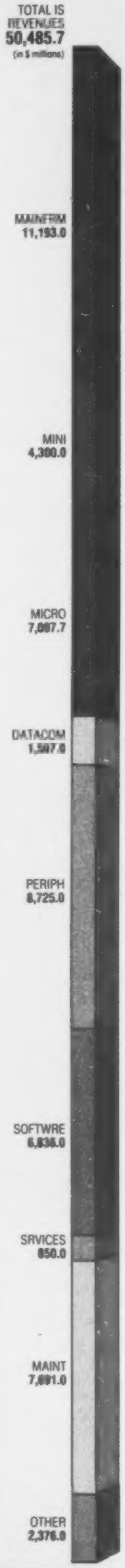
THE INSIDE STORIES

Tales of IS triumph, leavened with a few sagas of woe, reported by DATAMATION's international staff of correspondents.

In today's global economy, no vendor is "foreign" if it offers the business solution you need. So, the DATAMATION 100 is more than just a worldwide honor roll of computer industry success. It is a roster of IS suppliers without equal, 100 companies that deliver a global menu of tools for today's technology managers. DATAMATION's international network of reporters follows these companies throughout the year, getting the inside stories of strategies and technologies. The following section contains profiles of the 100 most successful vendors in the IS industry.* It is the saga of a hundred businesses, thousands of products, over 5 million men and women, and how they create the systems with which you help run the modern world. Together, the following companies had 1987 IS revenues of over $208 billion, which represents 80% of the world IS industry's total sales.

**To locate companies profiled, please see the index on page 141.*

Illustration by Darryl Ligason



1

INTERNATIONAL BUSINESS MACHINES CORP.

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(914) 765-1900

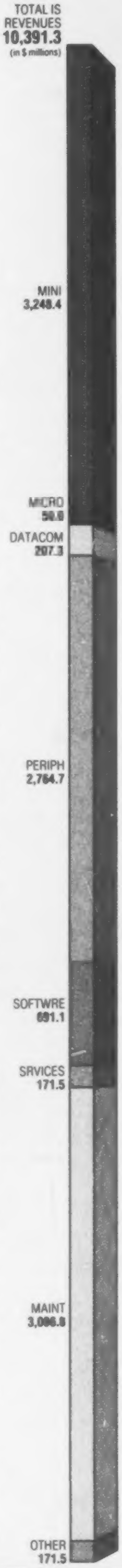
It wasn't sales of hot new products that swelled IBM's coffers in 1987, but fat fees from locked-in mainframe customers. It wasn't IBM's "VAX Killer," the new 9370 family, that made it the most profitable company in the U.S. once more, but the weak dollar. IBM's $5.26 billion in net profits owed more to the artful redeployment of thousands of people and to stringent cost-cutting than it did to a hunger for IBM's make-or-break family of new PCs, the PS/2.

IBM downsized to the point where it could be profitable on anything greater than a 5% increase in sales. IBM chairman John F. Akers' predecessors needed 12% to 15% sales increases each year to reap a profitable harvest. But they had the products to grow with the industry. Akers doesn't—at least, not yet. Only 5,000 of the 9370s were shipped in 1987, one eighth the order backlog IBM hinted at late in 1986. And while IBM claims it sold 1.5 million PS/2s between April 1987 and January 1988, dealers and market researchers claim IBM lost substantial market share and is now heavily discounting the PS/2s. Still, 309X unit shipments were up in 1987, the third year of volume shipments. Total sales of IBM's computer products—excluding copiers, defense electronics, etc.—were $50.49 billion in 1987.

Software, especially mainframe systems software, was the main reason IBM climbed to the top of the U.S. corporate earnings tree, accounting for some 60% of IBM's net profit. Software accounted for almost 13% of IBM's total sales, at $6.8 billion, a figure that was up by 24% over 1986. Compare this with worldwide product sales growth of just 3.9% and total maintenance revenue growth of 3.8%. The lion's share of software sales, perhaps 70%, came from large mainframe—308X and 309X series—software. Gross profit margins on such software typically exceed 70%.

Much of this profit now comes from overseas, with Europe contributing 42% of net earnings and 37% of total revenue. The numbers reflect not only currency translations, but also the fact that IBM's large European customers, especially banks, have been slower to move from proprietary technology than their U.S. counterparts.

None of this will mean much if IBM doesn't find a cure for its product palsy. Akers' prescription came in January 1988's restructuring. IBM has divided into six semiautonomous business units to fight a creeping, insidious bureaucracy, to reunite estranged product development and marketing arms, and to stop creating products in a vacuum.



2

DIGITAL EQUIPMENT CORP.

146 Main St.
Maynard, MA 01754
(617) 897-5111

In many ways, 1987 will be remembered as the year of new vistas for Digital Equipment Corp. The torrid pace of growth during the previous year continued unabated and its 18-month "window of opportunity" in the midrange opened wider.

IBM's preoccupation with untangling its product lines left DEC free to seize new accounts among Big Blue's traditional customers. Fueled by the spread of its VAX computers across a range of distributed applications, DEC's net climbed 49% to $1.2 billion on a 24% rise in sales to $10.4 billion.

Its midrange role secure, the company began making a place for itself in other industry segments and applications. With high-end VAX clusters, DEC moved to position itself across mainframe and communications markets: the first systems released in 1987 were the VAX 8974 and 8978, machines characterized by DEC as IBM 3090 equivalents.

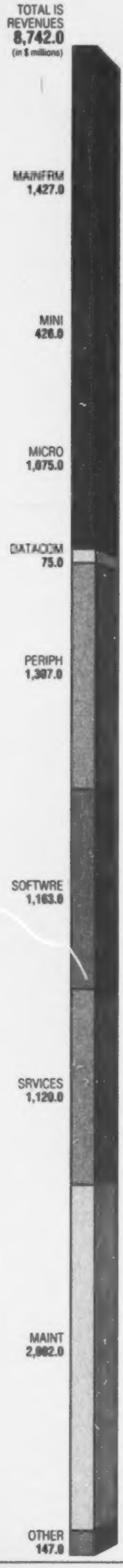
Elsewhere, the company began a campaign to link voice and data in VAX applications. Its Computer Integrated Telephony program—in conjunction with Northern Telecom Ltd. and British Telecom plc—aims to integrate existing data and telephone networks to mimic the capabilities promised by ISDN.

The mainframe and communications developments aptly illustrate DEC's move from a primarily midrange vendor to an all-fronts supplier, taking its fight into IBM's mainframe heartland, and expecting to compete in emerging applications markets against a broad set of competitors, including AT&T.

But progress was slow. Early appraisals of the VAX 8974 and 8978 showed more marketing bravado than mainframe success. Where mainframes count most, in on-line transaction processing, DEC did not satisfy expectations, and by year's end, a much awaited OLTP monitor for VAXs was nowhere in sight.

On the desktop, DEC was unable to command new ground. Despite the absence of the multitasking OS/2 operating system, DEC had its hands full at the low end. While its VAXstation 2000 and MicroVAX 3000 announcements showed the company willing to match microcomputer prices, the systems did not attract new customers, and primarily served to protect DEC's customer base.

Moreover, as Unix gained ground among its technical customers, DEC was forced to recognize slippages in its traditional engineering markets as well as opportunities in others. Stirred to treat its Ultrix version of Unix as more than a stepchild to the proprietary VMS OS, DEC promised to make Ultrix an integral part of its VAX environment.



3

UNISYS CORP.

1 Unisys Place
Detroit, MI 48232
(313) 972-7000

In the first full year since Burroughs and Sperry combined, Unisys Corp. set to the job of merging two large organizations while attempting to build a coherent new business strategy. By the end of the year, that Unisys strategy was becoming evident: it would continue to support traditional mainframe customers while beginning to emphasize networking, open systems, and value-added services, such as systems integration.

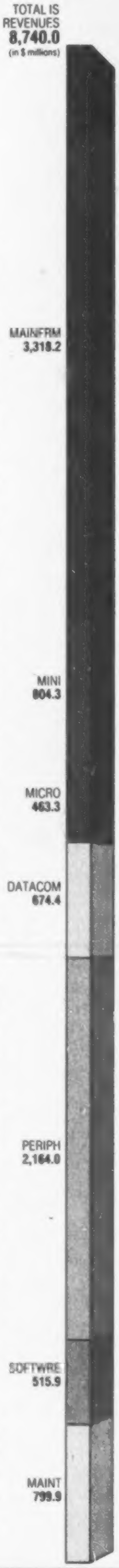
The company completed a restructuring of top management, and the departure of Unisys's second and third in command—former Sperry president Joseph J. Kroger and former Burroughs president Paul G. Stern—strengthened chairman W. Michael Blumenthal's hold on the reins of power.

To improve profitability and reduce debt, Unisys continued to control its employee head count, now at 92,500, and to trim operating expenses. That helped the company significantly enhance its 1987 income picture. Although its revenue increased only 6.8% for the year to $9.7 billion, Unisys showed $578 million in earnings compared with a loss of $43 million in 1986. Unisys also improved its operating profit margin to 12% in 1987 from 5% in 1986, and reduced its debt compared to capital by about 55%.

Unisys's emerging strategy calls for it to become more active in networking, so it acquired Timeplex Inc. of Woodcliff Lake, N.J., for $300 million in stock. A vendor of T1 data communications products, Timeplex should enable Unisys to sell communications products to its current customers and enhance its ability to provide more complete systems integration services.

Unisys continued to invest in products based on open systems standards, such as Unix and the Open Systems Interconnection model. Unisys merged the Sperry and Burroughs Unix-based product lines and, early in 1988, announced it would design a new group of Unix products around the RISC-based SPARC microprocessor from Sun Microsystems Inc., Mountain View, Calif. Unisys joined with Sun and AT&T in an effort to develop a single, standard version of Unix. Unisys says its small-systems business—most of it Unix—will be as large as its mainframe business within a year or two.

The company continues to beef up its mainframe product lines, enhancing both the bottom and the top of the A Series family, and broadening the 2200 product line introduced in 1986 as an upgrade path for low-end users of its older 1100 Sperry mainframe line. High-end 1100 users are waiting for similar relief.



4

FUJITSU LTD.

6-1 Marunouchi 1-chome
Chiyoda-ku, Tokyo 100, Japan
(81-3) 216-9365

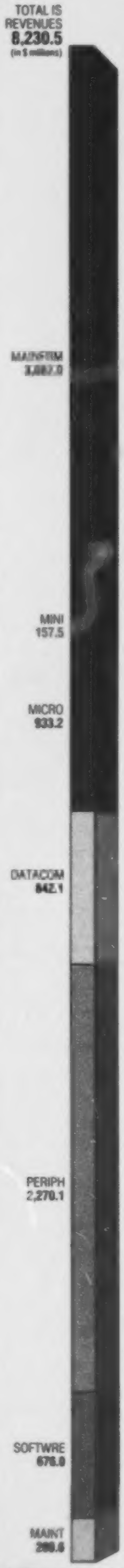
Fujitsu's 1987 settlement of its operating system software dispute with IBM has calmed customers' anxiety: the fear of having to retailor everything to accommodate new software will no longer cause customer hesitation to buy.

Before the settlement, during the first quarter of 1987, 44 of its top-of-the-line M-780 models were shipped. Nonetheless, Fujitsu's prospects until the settlement were cloudy enough that the growth of its mainframe sales, estimated by DATAMATION at 15.3%, wasn't what it might have been. Overall sales of Fujitsu's computer products rose 14.1% to ¥1.3 trillion ($8.7 billion).

Domestic market conditions favorably affected other equipment categories. Early in the year, for example, Mitsubishi Bank ordered 4,000 counter terminals, 400 terminal controllers, 300 automated teller machines, and 900 automatic deposit machines, worth over ¥10 billion ($69 million). Sales of micros boomed by an estimated 17% as Japanese corporations made "office workstations" a key element in the networks they were building.

In the U.S., results were mixed. An attempt to acquire Fairchild Semiconductor Corp. fell through because of U.S. government objections, but the company will build a semiconductor wafer plant and expand existing disk drive production in Oregon. A Dallas plant will be expanded to increase communications equipment production. With assets acquired from Intelligence Storage Inc., Fujitsu set up a subsidiary in Longmont, Colo., called Intellistor Inc., to design and develop disk drives, controllers, interfaces, and other equipment. A joint venture with GTE was formed to develop and market PBXs for the U.S. market.

Along the Pacific Rim, plans were made for a communications equipment plant in Dandenong, Victoria, Australia. A new plant near Bangkok will produce magnetic and printer heads, and later will add printers and facsimile machines. A deal with South Korea's Hyundai Electronics Industries will produce digital PBXs, using major components supplied by Fujitsu. A joint venture with Dong Hwa Electronics will more than double its output of magnetic heads, as well as begin production of printer heads. Electromagnetic relay production in Malaysia also will be increased. Turning its attention to the largest Pacific Rim country, the company negotiated for software development with several Chinese institutions, including East China Teachers' College in Shanghai and the Ministry of Posts and Telecommunications; the moves are expected to give Fujitsu a leg up in future telecom sales.



5

NEC CORP.

33-1 Shiba 5-chome
Minato-ku, Tokyo 108, Japan
(81-3) 454-1111

Japan's healthy domestic economy helped NEC rack up respectable growth in its 1987 IS sales, which were up 11.6% to ¥1.2 trillion ($8.2 billion). Its position as the alternative pcm supplier, however, was eroded by IBM's recent peace treaties with Hitachi and Fujitsu. Overseas, NEC was helped by its 15% share in the Honeywell Bull joint venture. Nevertheless, like most Japanese electronics makers, NEC's export ratio fell to 27%, a drop of 2%.

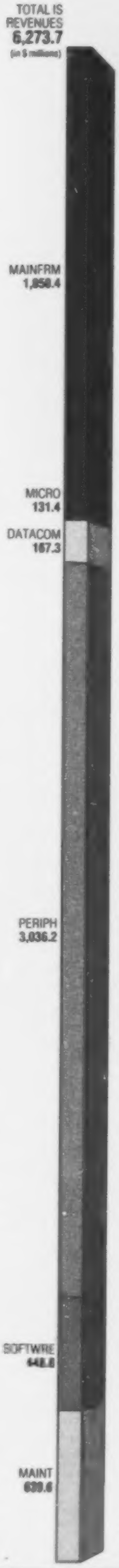
At home, NEC's majority domination of the domestic pc market gave it the advantage as Japanese corporations turned to pcs as key elements in expanded corporate information systems aimed at white-collar productivity. Since NEC's pc sales are concentrated at home, it suffered less than did competitors Toshiba and Seiko Epson from U.S. tariffs imposed as punishment for violations of the semiconductor agreement.

There are moves afoot on several fronts, however, that may chip away at NEC's pc lead. One effort is the agreement by most of the other major Japanese electronics firms, with Microsoft, to develop the AX standard, which will be an AT-compatible operating system with Japanese language capability.

Seiko Epson attacked from another angle early in the year with the unveiling of a pc that is compatible with NEC's best-selling 9801 series of 16-bit machines. NEC struck back with a lawsuit charging violation of its BIOS copyright. The two reached a settlement involving payments of an undisclosed value. Seiko Epson never put the disputed model on the market, but it is now selling several noninfringing 9801 clones, and, in November, it stepped up the pressure by introducing a NEC-compatible laptop for the domestic market.

Despite NEC's participation in the development of the TRON 32-bit operating system at the University of Tokyo, it, too, may present a challenge: it is expected to serve as the basis for the pcs to be installed in all junior and senior high schools under the Ministry of Education's revised curriculum.

Like most Japanese electronics makers, NEC stepped up overseas production to help deal with the appreciating yen. It announced plans in January to set up a U.K. subsidiary to manufacture vcrs; production will later expand to tvs, mobile phones, facsimile machines, and other communications equipment. In early summer, NEC boosted pc production at its Foxboro, Mass., plant, and began test production of laptops in Atlanta. Later, it began producing VSAT (very small aperture terminal) satellite data terminals at its cellular telephone plant in Portland, Ore.



6

HITACHI LTD.

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Chiyoda-ku, Tokyo 101, Japan
(81-3) 253-2186

Hitachi's revenues were down in 1987 for the second year in a row, as the weak dollar decreased the yen value of export sales. In response, the company pushed domestic sales and moved production overseas. But profits still suffered, as income fell 14.7% to ¥106.2 billion ($734 million). Still, IS revenues racked up a healthy increase, estimated by DATAMATION at just under 14%.

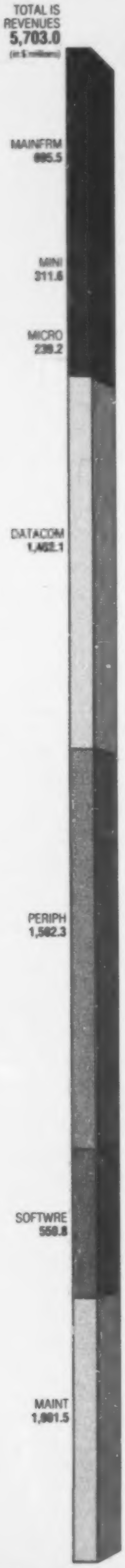
Mainframe sales increased an estimated 15.8%, thanks to a strong domestic market driven both by the installation of third generation on-line systems by most financial institutions and the information systems built by service companies to increase white-collar efficiency. The nonacrimonious settlement in 1986 of the operating system software dispute with IBM also gave Hitachi a slight edge over Fujitsu in mainframes for much of 1987.

Overseas sales continued to be strong, but because of the cheap dollar, they contributed less to revenues. An agreement with Unisys, based on an earlier tie-up with Sperry, to develop the upcoming Unisys 100 Super 90 mainframe added another critical overseas connection. The company also has mainframe links with BASF and Siemens AG of West Germany, Olivetti of Italy, GoldStar of South Korea, and NAS of the U.S.

Workstations such as the 2020 and 2050 were pushed hard, and Hitachi was rewarded with an estimated 19.4% increase in micro sales. In December, the company introduced its first minicomputer, the HITAC E7700, which runs Unix System V 3.0. With it, Hitachi hopes to grab 10% of the domestic supermini market in the next four years.

Signs of a plan to increase overseas software development cropped up in several places. In the spring, a software development laboratory was set up in London under the auspices of Hitachi Europe Ltd., the company's European marketing arm. The move was seen as an indication that Hitachi plans to sell computers in Europe under its own name eventually. The new software would be for workstations. A similar effort was begun in Santa Clara, working through Hitachi's Marketing Systems Div.

Hitachi bought into Hyosung Data Systems, a key software producer and part of one of the 10 largest business groups in South Korea. It will sell Hitachi minicomputers and workstations for financial applications while it develops software. Computer centers set up in New York and London to sell timeshared processing services to Japanese financial firms may also serve as a source of local software development.



7

SIEMENS AG

Wittelsbacherplatz 2
D-8000 Munich 2, West Germany
(49-89) 2340

Siemens' IS revenues managed to break through the DM10 billion barrier for the first time last year, but it wasn't easy.

A flaccid West German economy, a strong deutsche mark that decreased foreign revenues by $1.1 billion, and weak international demand in some sectors drained profits. Fiscal pessimism was compounded when an unprecedented decision to cut dividends following the October 1987 stock market crash left its shareholders shocked and analysts worried.

In the IS sector, Siemens pushed its revenues up by 7.7% to DM10.25 billion ($5.7 billion) in 1987. This increase came mostly from its traditional European markets, which accounted for 87% of its business in 1987.

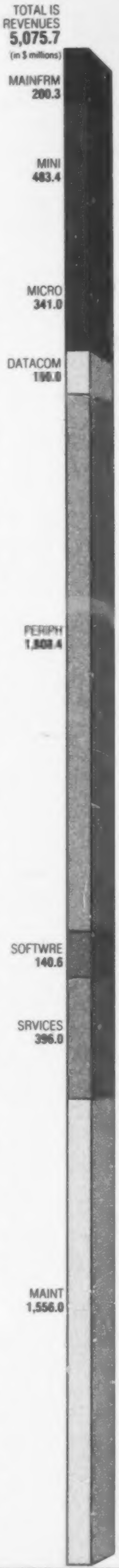
Mainframes remained big money-makers, but Siemens dropped efforts to market the IBM-compatible boxes, instead setting up a joint venture with BASF called Comparex, which began operations on Jan. 1, 1987. Siemens continues to sell its own machines and Fujitsu systems running Siemens' BS2000 operating system.

Siemens hoped for substantial growth from sales of its Sinix version of Unix, but it has not met expectations. So far, Siemens claims orders for 20,000 computers with the multiuser, multitasking Sinix.

Information systems accounted for more than 50% of the sales of the Communications and Information Systems Group—double its IS revenues of five years ago. While these sales flourished, the company had problems with its PBX line. Siemens' strategic decision to push Hicom, its ISDN switch, has brought in more than 2,750 orders so far. But the business has not led to profits: Siemens confirms that the operation is losing money and some reports put the shortfall at DM200 million ($111 million) worldwide during 1987.

Siemens' high-performance laser printers proved a lucrative business, as the company continued its hold on 25% of the world market and 50% of the European market. Siemens has set up nine business centers in the U.S., concentrating on oem distribution. Approximately one half of Siemens' laser printers are delivered to the U.S.

Last year, Siemens made a concerted effort to spread its business abroad. Along with its new U.K. IS subsidiary, Siemens Ltd., which is reporting an annual aggregate growth of 15% to 20%, the company signed deals in China and India and founded an R&D center, Webel Telematiqs, which will tap India's R&D expertise. This international R&D policy is expected to broaden in 1988.



8

NCR CORP.

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(513) 445-5000

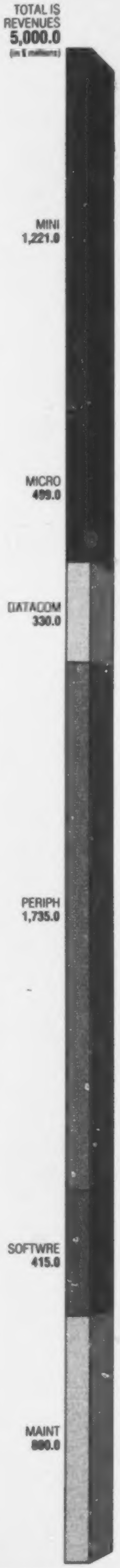
Careful—and early—positioning in the world of Unix and micros has helped this venerable company emerge reborn: a wealthy beneficiary of the trend toward "free market" computing. Despite its 104 years, the NCR of today is a new company: only the acronym remains. Cash registers, accounting machines, innumerable families of terminals have come and gone. All is new, even in relatively mature business segments such as retail and financial workstations and large systems—and virtually all is profitable.

Many pay homage to NCR chairman Charles Exley. Whether it's plain old-fashioned hard work or second sight on his part, the numbers speak for themselves: record orders, revenues, and profits—a record year by any financial measure. Net income jumped 25% to $419 million. Total revenue advanced 16% to top $5.6 billion. By the year's end, this cash machine had racked up nine straight quarters of double-digit growth.

The key to NCR's regeneration is what it calls the "standard platform." A platform is a set of rules, interfaces, and components that can be a base for many different products. The fewer the platforms, the greater the yield from R&D, the lower the production cost, and the higher the volume. Products can be turned over in months rather than years.

All of NCR's product lines—pcs, workstations, minis, and mainframes—are now micro-based and increasingly feature standard industry operating systems (MS/DOS, Unix, etc.). With such platforms, NCR has been able to carve out new business segments: general purpose workstations (pcs and office automation workstations) have grown to nearly $350 million from nothing in five years. Last year, this sector grew 24% and contributed almost 11% of total equipment revenue. Growth in NCR's Unix-based Tower minicomputer business was spectacular, providing the bulk of NCR's small- and medium-systems revenues and the fuel for this group's 32% increase.

However, there are dangers in all this downsizing. Customers of existing proprietary mainframes—usually NCR's biggest customers—feel they've been getting the short end and a number in the high-volume OLTP sector have defected to IBM and Tandem. So far, the company's innovative multiprocessor-based 9800 series, which began shipping last year, has not proved to be the answer. A lack of key systems software (some of which, such as its Multi-Tran transaction processing monitor, was eventually announced in 1987) and third-party applications have so far ensured a lukewarm response to NCR's big machine.



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HEWLETT-PACKARD CO.

3000 Hanover St.
Palo Alto, CA 94304
(415) 857-1501

That sigh of relief you heard recently probably emanated from Hewlett-Packard: it finally shipped its first RISC-based Spectrum models aimed at business applications. After delays, hundreds of millions of development dollars, and countless references to HP's "RISCy business," HP can now sell RISC-based business systems in addition to talking about them.

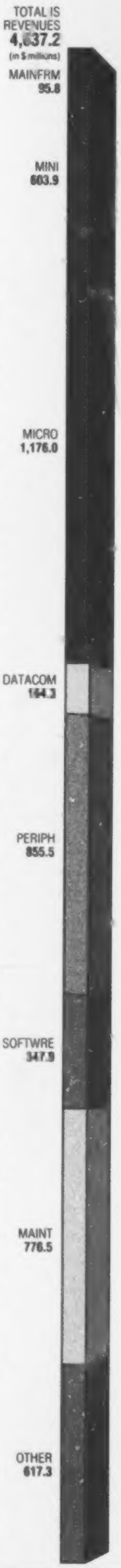
The current low end of the new Precision Architecture (as Spectrum is formally called) for business, the HP 3000 Series 930, began shipping Aug. 19. The HP 3000 Series 950 followed a month later. Volume shipments for each were not scheduled until 1988, however. While HP seems to have solved the key operating system problems that caused Spectrum's delay, it now faces other software challenges, among them getting accompanying database products up to speed.

After a rather lackluster 1986, HP gave its shareholders good news in 1987: revenue increased 14% to $8.09 billion and earnings jumped 25% to $644 million. All of HP's sectors contributed to the gains, but the company was helped particularly by overseas orders. While U.S. orders gained 11%, international orders galloped ahead by 22%. Marketing and selling expenses grew by 15% while R&D costs actually dropped half a percentage point to 11.1% of net revenue. Other costs were kept in line, as employment stayed stable at 82,000 worldwide.

HP was particularly pleased with its HP 9000 Unix-based Spectrum models, aimed at engineering and manufacturing. The first model had shipped in November 1986. In May 1987, three new models were introduced, ranging from the HP 9000 Model 850S supermini down to the Model 825SRX workstation.

In accord with a long-stated goal of multivendor connectivity, HP announced 70 new networking products in 1987, including support of IBM's Network Basic I/O system. It also announced new LaserJet printers and Vectra pcs, including portables and 32-bit 80386-based models. New Wave, an adjunct to the PC-compatible line, is a software environment that allows PC users to work across applications and draw data and files from multiple sources. Unfortunately for HP, it was hit early in 1988 with a lawsuit from Apple Computer Inc., charging that New Wave infringes on Macintosh graphical elements.

In 1987, cofounder William Hewlett retired as a director and vice chairman, but said he'd continue to participate as a nonvoting board member. The next generation emerged, as Walter Hewlett and David Woodley Packard, sons of the founders, joined the board.



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ING. C. OLIVETTI & CO. S.P.A.

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10015 Ivrea, Italy
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In May 1987, Olivetti chief executive officer Carlo DeBenedetti predicted that the year's revenues would be higher than ever, topping L8 trillion ($6 billion). By year's end, revenues had reached only L7.4 trillion ($5.7 billion) compared to L7.3 trillion ($4.9 billion) in 1986. Net profit was down nearly 30% to L402 billion ($310 million) from 1986's L566 billion ($379 million).

Olivetti blames the downturn partly on the L100 billion ($77.1 million) cost of restructuring its West German office equipment subsidiary Triumph-Adler. The vexing 75% decline in sales of personal computers to partner AT&T didn't help: AT&T bought only 40,000 pcs in 1987 compared with the 200,000 it bought the year before. Olivetti says Triumph-Adler will break even in 1988 and that AT&T will order more pcs this year.

Major product introductions came at midyear and at the year's end. In June, Olivetti introduced a new line of pcs based on Intel's 80386 and 80286 processors. Models include the M380, M280, S281, and M240, which offer MS-OS/2, Xenix, Unix, and MS/DOS. With these models, Olivetti became the first European computer maker to introduce a challenger to IBM's PS/2. In addition, Olivetti launched a line of pc applications software called Olisoft Library.

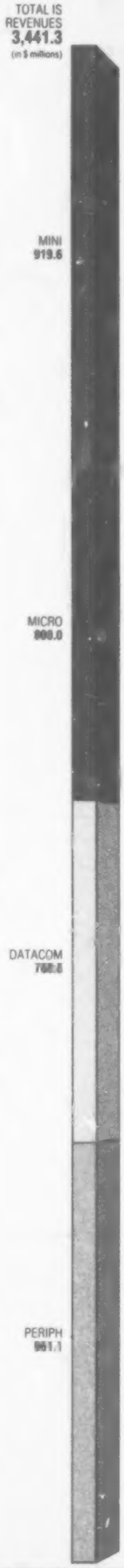
In November, DeBenedetti launched what he described as "a new Olivetti: the Olivetti of the minicomputer age." The company introduced the LSX 3000 line of Unix minicomputers, which use the 32-bit Motorola MC 68000 processor.

Previously, Olivetti has successfully marketed its own Linea Uno (Line 1) minis, AT&T's 3B line, and, recently, Stratus Computers' line of fault tolerant machines. The new LSX line is not made by AT&T, and AT&T says it will not buy the line for sale in the U.S.

Along with the LSX computers, Olivetti launched Open Systems Architecture (OSA) to link its IS products and services. Olivetti says OSA will be its central theme for products and services over the next few years.

This spring, AT&T was scheduled to exercise its option to raise its 25% ownership stake in Olivetti to a 40% maximum. During 1987, however, the companies postponed the option deadline until 1990.

In April, Vittorio Cassoni gave up his job as head of AT&T's computer operation and returned to Olivetti as managing director. Meanwhile, AT&T is talking to Italian telecom firm Italtel about a joint venture deal. If the talks are successful, Olivetti is likely to get involved as a third partner.



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TOSHIBA CORP.

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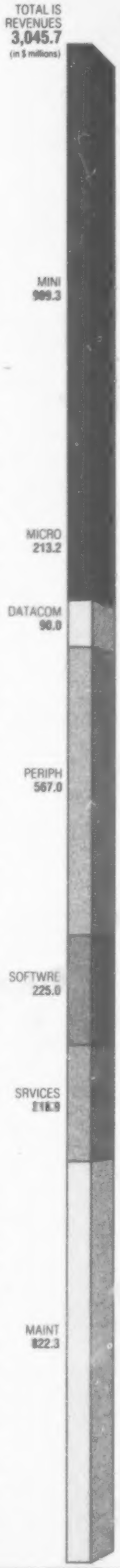
Toshiba Corp. suffered less damage to its balance sheet from subsidiary Toshiba Machine Co.'s sale of submarine propeller technology to the Eastern Bloc than might have been expected. Part of the credit goes to a superb damage control campaign: full-page apologies appeared in U.S. newspapers, chairman Shoichi Saba and president Sujiichiro Watari resigned, and lobbying on Capitol Hill proved effective.

Still, 1987 sales to the U.S. decreased by 10% from 1986. A healthy domestic economy helped boost consumer revenues, and the company squeezed out a 1.5% increase in overall sales after a drop the previous year. IS revenues grew by a respectable 13.4% to ¥497.7 billion ($3.4 billion), almost in step with those of its industry-leading rivals. Profits were up an estimated 9.3%.

For the second year in a row, Toshiba was hit hard by the dollar's falling value, which cut export revenues even when volume was maintained. Further, its hottest sellers in the U.S. market, the T1100 and T3100 laptop pcs, were nailed by 100% tariffs imposed in retaliation for Japanese violations of the previous year's semiconductor agreement.

Toshiba fought to protect its laptop revenues on two fronts. First, it hastily arranged for assembly in Irvine, Calif., using U.S.-purchased microprocessors. That didn't help when it came to selling to the government, though, and it lost a 90,000-machine order from the Air Force. Later, a ban was formally imposed on Pentagon procurement of Toshiba products. The other approach was to try to cash in on the booming domestic Japanese economy by introducing Intel 80386-based Japanese language versions of the laptop. The first such machine was introduced in December, however, so it had little impact on 1987 revenues.

With an aim to buy technology, to beat the high yen, and to reduce trade frictions, Toshiba increased its overseas operations. It agreed on the joint development and marketing of facsimile machines with Telic Alcatel of France. In the spring, it agreed with Motorola to set up a joint semiconductor manufacturing plant north of Tokyo. Toshiba will bring memory chip expertise and Motorola microprocessor designs to the table. With Computervision, Toshiba will jointly develop Japanese versions of Computervision's CAE/CAD/CAM workstations and software in Japan. In a similar arrangement, it will cooperate with SDA Systems of San Jose on VLSI circuit design software, which will then be incorporated into Toshiba's CAD systems.



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WANG LABORATORIES INC.

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Lowell, MA 01851
(617) 459-5000

Wang's gloom of the past few years began to clear in 1987. President Frederick A. Wang's dose of discipline and financial controls paid off with steady improvements. Stronger domestic and international results combined to produce four quarters of higher sales and profits. By the third quarter, the growth in sales and earnings were such that Wang could boast that the worst was behind it. In the fourth calendar quarter, orders for Wang services and equipment reached an all-time high.

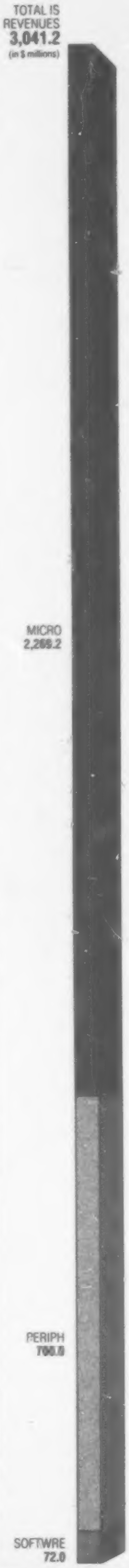
A return to better days was evident in many ways. An invigorated sales force repaired damaged relations with customers; shipments of the much delayed VS 7000 high-end computers ramped up; and the April debut of the Wang Integrated Image Systems (WIIS) added a product that competitors such as IBM and Digital Equipment Corp. could not match.

Able to mix images stored on optical disks with data from VS computers, WIIS was greeted as an unrivaled boon to the company's VS and financial systems marketing efforts. With WIIS's debut, Wang claimed a year's lead over its main competitors in the financial systems market. WIIS contributed to Wang's winning a multimillion-dollar, multitechnology agreement with National Mutual Life Association, Melbourne, Australia.

Buoyed by high-end VS shipments and end-of-the-year purchasing, Wang's sales reached $3 billion, up 14.1% from the previous year. Pent up demand for the VS 7000 led to more than 1,000 shipments of the high-margin systems. A profit of $94.5 million marked a dramatic contrast to 1986's $86.4 million loss. Yet, despite strong sales and a return to profit, earnings did not match Wang's pre-1985 glory days.

Past problems have not been totally eliminated either. Despite an overhaul of its low-end and midrange models, newer VS computers relied on cost-reduced and repackaged versions of earlier VS cpus. The nine-month lead times that came with December's unveiling of the much ballyhooed VS 7320, a dual processor based on the VS 7310, echoed similar delays with earlier VS high-end computers.

Even WIIS, the budding star of the product line, was not immune from long lead times. Volume shipments of the high-end WIIS systems were delayed by up to three months with no reasons given. Such delays did nothing to bolster the image of a company with reins firmly in hand. Still, there was good news: VS/VM, a virtual machine capability that enables a single VS computer to appear as multiple logical machines, was shipped at its announcement in December.



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APPLE COMPUTER INC.

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Cupertino, CA 95014
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Marking its first decade in high style, Apple Computer Inc. posted financials that even Wall Street could love. The year featured Apple's first billion-dollar quarter (ended Jan. 1, 1988), shipment of powerful new Macintosh microcomputers, greater emphasis on communication with IBM equipment, and several significant executive shifts. Even more telling, for every dollar Apple earned, it's a good bet that there exists a corresponding press clipping stating that this was the year Apple made it onto corporate America's desktop.

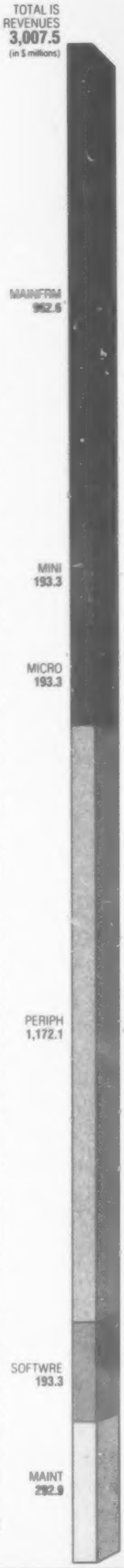
For the calendar year, Apple recorded sales of more than $3 billion, 50% over its $2 billion of 1986. Net income also skyrocketed, reaching $280.5 million compared with the $155.3 million earned a year earlier. One sign of maturity was Apple's first-ever quarterly cash dividend.

One complaint from some analysts was that more of Apple's sales did not come from overseas. For example, in the last calendar quarter, 28% of revenues were international, just a slight increase from the 26% recorded in the corresponding period in 1986. In response, and as part of a reorganization of its marketing efforts, Apple in April split its overseas operations, creating one for Europe, another for Asia. The company also announced a regional R&D center to be located in Paris.

Apple kept busy on the product side. In March, it announced the Macintosh SE (System Expansion) and high-end Macintosh II. Their shipments helped the Mac family's sales outpace those of the Apple II line for the second year in a row. The Mac now generates roughly 60% to 65% of Apple's computer sales. Other announcements included HyperCard, an intriguing software environment to allow customization of information, and the AppleShare file server software. This January, Apple announced a long-anticipated joint development pact with Digital Equipment Corp.

The one black cloud in the product sky was the difficulty in shaking A/UX, Apple's first implementation of Unix, out of the tree. Expected in the summer of 1987, it didn't appear until February 1988.

April 1987 held another first for Apple: a spin-off. In response to complaints from independent software developers of unfair competition, Claris Corp. was formed to develop and sell software for Apple systems. Apple executive vice president William Campbell moved over to head Claris, which shipped its first products in January 1988. Claris may go public later this year. Among other Apple investments was a minority stake in networking startup Touch Communications Inc.



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GROUPE BULL

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Bull disappointed in 1987, having achieved a meager 1.5% growth in revenues and then reporting a 17% drop in its already modest earnings. Revenues amounted to FF18.1 billion ($3 billion), up from FF17.8 billion ($2.6 billion), and profits were FF225.2 million ($37.5 million). (The profits for Groupe Bull include its $17 million share of the earnings of Honeywell Bull Inc., in which it acquired a 42.5% holding under an agreement signed in March 1987.) Approximately 64% of revenues, FF11.6 billion ($1.9 billion), came from sales on its home turf, which is a drop of 1% from the year before. Foreign revenues advanced by 6% to FF6.5 billion ($1.1 billion).

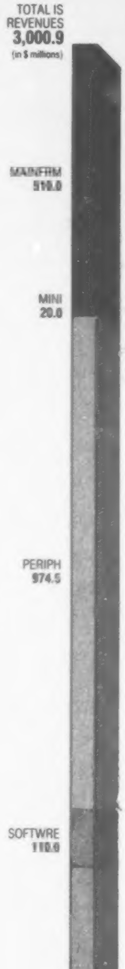
The profit in 1987 was owed to considerable cost-cutting in domestic operations. Bull's French work force shrank by 800; a further 700 jobs are to go in 1988.

On the product front, Bull launched the DPS 7000 series at Sicob, the French computer show, in April. The five-model line was designed as a medium-level complement to the DPS 7 family. Other additions to the DPS 7 range during 1987 included extensions in the middle of the range and six top-of-the-line models, the DPS 7/1X07 series, comprising from one to four processors. The GCOS 7-XLS operating system was also improved.

Bull's family of GCOS 8 large systems was expanded during the year with the June announcement of the DPS 8000 series. Designed as a successor to the DPS 8, it was positioned just below the most powerful systems in Bull's range, the DPS 88 and DPS 90. The new line was brought to the market shortly after the introduction of an improved version of the GCOS 8 operating system, called the SR 3000.

Bull also filled out its micro offerings in 1987, beginning with the Micral 40, a compact, modular, 286-based micro that fit into the middle of Bull's micro offering (then comprising the Micral 30 and 60). Toward the end of the year, the line was further expanded with the simultaneous announcement of a portable (the Micral 15, known as the Attaché) and a 286-based replacement for the Micral 30, called the Micral 35.

Bull reiterated its commitment to Unix in 1987, announcing in November that in the future it and Honeywell Bull would develop their Unix offering jointly. During the year, Bull made its version of Unix (Spix) available on a number of systems, including some models in the SPS 9 range of RISC minis (supplied by Ridge Computer, Santa Clara), the DPS 4000 series, and a new family of three supermicros, the Questar 700.



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CONTROL DATA CORP.

8100 34th Ave. S.
Minneapolis, MN 55420
(612) 853-8100

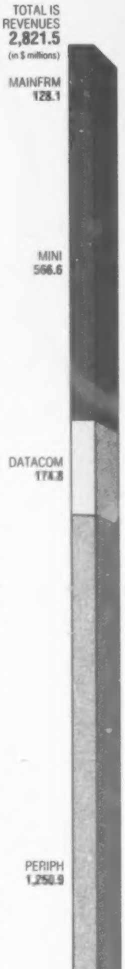
Control Data returned to profitability in 1987 after two years of massive restructuring and cutting back. Although revenues from its computer products and business services (excluding sales of military electronics systems) were essentially flat at just over $3 billion, net income was $19.3 million, a big improvement over the $264.5 million in red ink the company spilled in 1986.

The cost related to restructuring in 1987 was $107.6 million. CDC has shed some 20 businesses since 1985, focusing instead on its core businesses, particularly data storage products, computer systems, and business services. It seems on its way to recovery, thanks mainly to the no-nonsense strategies developed by its chairman, Robert M. Price, the handpicked successor of founder William C. Norris.

In the disk drive business, CDC introduced a family of high-performance 3½-inch rigid disk drives to be made in a new plant in Singapore. The data storage unit hit a snag in 1987, when the company's 9-inch disk drives failed and had to be replaced, at a cost of $21.5 million. Results at the year's end showed revenues from CDC's data storage business down nearly 10% to $974.5 million.

The company made big strides in its computer systems business, introducing new products and enhancing existing ones. CDC rolled out the 930, a departmental computer that compares to a VAX 8500 in performance but costs 57% less. The Cyber 910 family of workstations, oemed by Silicon Graphics, was expanded with four new models that have real-time 3-D color graphics. CDC strengthened its ties to Silicon Graphics by acquiring 20% of the company. CDC improved performance of its 990E and 995E high-end mainframes and introduced a new disk system for the 990 that gives it channel speeds four times faster than those of an IBM 3090.

Orders began coming in for the ETA10, made by CDC supercomputer subsidiary ETA Systems, St. Paul. CDC has sunk between $100 million and $150 million into the venture, which reported slight revenues. The company had five orders for the machine, priced between $19 million and $27 million, including a $20 million contract to supply an eight-processor ETA10 to a Japanese university and a $6 million contract with NASA. Meanwhile, ETA introduced two entry-level, air-cooled models, the ETA10-P and -Q, priced under $1 million. Also debuted was a common Unix operating system across the Cyber and ETA10 families, and support for NOS/VE, CDC's proprietary mainframe OS, on ETA's supercomputers.



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NIXDORF COMPUTER AG

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While European industry analysts asked how much longer Nixdorf could maintain its rapid growth, the company steamed ahead in 1987 with a 13% increase in revenue to DM5.1 billion ($2.8 billion).

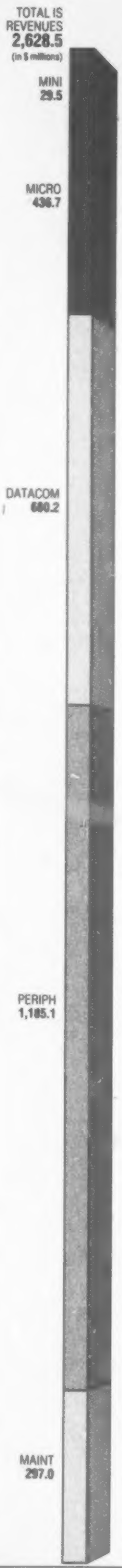
"We can generate growth," chairman Klaus Luft said at a recent press conference. "The market is certainly there." Nixdorf's strategy as a supplier of total computer systems has allowed it to target and tend market niches carefully. It is a strong supplier among small-business users, retailers, government agencies, and banks in Europe, offering broad IS solutions. Half of Nixdorf's sales last year came from software and services. Data communications accounts for a smaller but significant piece of Nixdorf's business, with datacom revenues up 12% to DM314 million ($174.8 million). Some 5,000 of its ISDN 8818 PBXs are in place in 15 countries.

Of office and manufacturing users, Luft says, "Unix is on everyone's tongue." The Targon family of Unix systems grew to include pc workstations, supermicros, multiprocessor systems based on RISC, and fault tolerant multiprocessor systems. The Targon computer's relational database concept helped attract customers, including the U.S. Air Force and several West German industrial giants.

Although less than 10% of its business is outside Europe, Nixdorf seems determined to strengthen its international presence. The firm now operates from some 580 bases in 48 countries, and 1987 saw an aggressive push to penetrate the U.S. market, where 1,500 Nixdorf employees helped bring about a 50% increase in orders. Despite a major contract with Montgomery Ward & Co., U.S. operations remain in the red.

Nixdorf hired almost 4,000 more workers last year, bringing its worldwide work force to nearly 30,000, over half of which is in customer sales and support. Nixdorf expanded its production capacity, spending DM2.7 billion ($1.5 billion) on state-of-the-art machinery in the last five years, and DM700 million ($389 million) in 1987.

Nixdorf's R&D outlays totaled DM477 million ($265.4 million), part of it invested in a DM15 million ($8.3 million) joint research project with the West German government to develop IS answers to environmental problems. Analysts expect environmental monitoring and protection applications to be big business in the next few years. In Singapore, Nixdorf has invested DM55 million ($30.6 million) in a center for Unix R&D. Nixdorf will also cooperate on Unix projects with Amdahl Corp.



17

MATSUSHITA ELECTRIC INDUSTRIAL CO.

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Osaka 571, Japan
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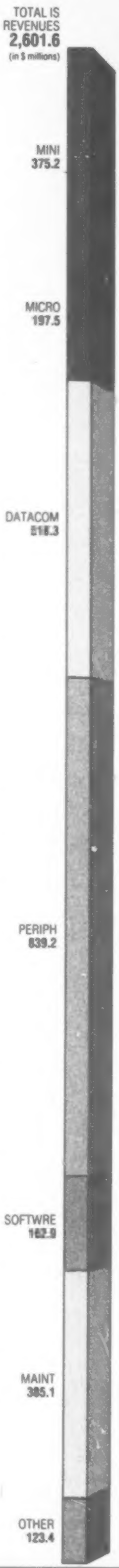
The year began with bad news for Matsushita. For the first time in 11 fiscal years, both sales and profits had declined. The biggest downward force was the continuing slide of the dollar against the yen. General Electric decided it could get its color tv sets made more cheaply elsewhere and canceled a big, long-standing deal. U.S. sales of vcrs dropped, and video equipment contributed only 26% of sales in 1987, down from 29% the year before.

Nonetheless, good strategy and good luck produced the beginning of an upturn for Matsushita in 1987. IS products get some of the credit, growing 14% to ¥380.1 billion ($2.63 billion). But despite the increased emphasis management has put on IS to help lessen reliance on unpredictable consumer markets, it remains a small part of overall sales (less than 10%).

A copyright dispute with IBM over the BIOS used in 2,000 AT compatibles exported to the U.S. brought a halt to Matsushita's manufacturing of compatibles. The settlement included payment to IBM of ¥300 million ($2 million at that time). Later, Matsushita joined the group working to develop the AX microcomputer standard, an operating system compatible with ATs but possessing Japanese language capability. Matsushita is also a member of the association working on the TRON 32-bit Japanese standard. An odd move was the introduction of a pc that is compatible with Fujitsu's less than blockbusting FM-R series machines.

Matsushita's overall export ratio fell to 29% last year from 33% the year before. On the other hand, the home market began to look a lot better thanks to a healthy domestic economy, in large part the result of government stimulation.

Matsushita did plenty to try to cope with its radically changed circumstances. In a standard move for Japanese firms, it increased overseas manufacturing, aiming to grow it to 25% of sales in three years from the approximate 10% it accounts for now. Plans were laid to begin making facsimile machines and to triple factory automation equipment output in Singapore; to design and build factory automation equipment (most likely in Pennsylvania); and to make wiring devices and boards in Taiwan, compressors and rotors in Malaysia, electric motors and vcrs in West Germany, vcrs in France, and tv picture tubes in Ohio. In April 1988, aiming to unite its sales efforts within a single global strategy, Matsushita merged with its subsidiary handling overseas sales, Matsushita Electric Trading Co.



18

N.V. PHILIPS GLOEILAMPENFABRIEKEN

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The Netherlands
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Dutch giant Philips spent much of last year defining its strategic goals in the IS business. Although the company's Telecommunications and Data Systems Div. (TDS) was established back in 1985, it took more than a year of protracted internal reorganization before its managers finally set to the serious business of planning the division's future.

Philips put most of its IS eggs in the open systems basket when it announced its Sophomation product strategy a couple of years ago. This concept consists of open networking architectures and connectivity protocols that allow some integration of voice and data technologies and the mixing of Philips equipment with that of other vendors. Despite success with the Sopho S PBX—which is at the heart of the networking concept—the ideal still surpasses the reality.

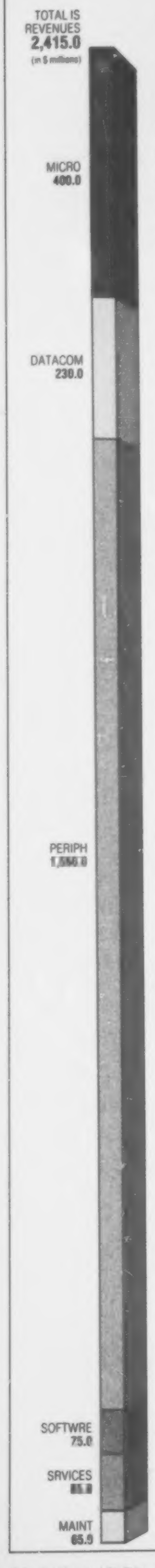
The outcome of last year's corporate self-analysis was a realization that its fragmented marketing structure around the world needed coordinating, its image as a serious IS supplier needed improving, and its ability to provide industry sector solutions needed beefing up. Philips has begun to focus more on its core businesses, particularly in the transportation, finance, and insurance sectors.

The financial effects of this strategy may not be felt until this year. Even so, Philips reported its IS business up by a healthy 10% to G5.3 billion ($2.6 billion) from G4.8 billion ($1.97 billion) in 1986. Both figures include Philips' IS activities in the TDS division and sales of IS products through its other industrial and medical divisions. (These sales had not been reported in the 1986 DATAMATION 100; the 1986 figures have been restated.)

The Sopho S PBX business performed well last year: the number of units sold were up by 10%. Philips also signed three licensing deals for the PBX in China, as that nation bids to reform its industrial and commercial base; Philips hopes to be a key IS supplier.

Philips launched its flagship P9000 line of 32-bit minicomputers during 1987, which consists of two main types of product: the P9X00 series, designed by Philips and at the heart of the company's comprehensive range of financial terminal systems, and the P90X00, essentially a Motorola machine aimed at the departmental and var markets.

Philips' most encouraging product in 1987 was its Megadoc optical disk storage system. Sales began to take off after three years of marketing, reflecting the growing trend among large organizations in Europe to automate archives with optical technologies.



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XEROX CORP.

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Stamford, CT 06904
(203) 329-8700

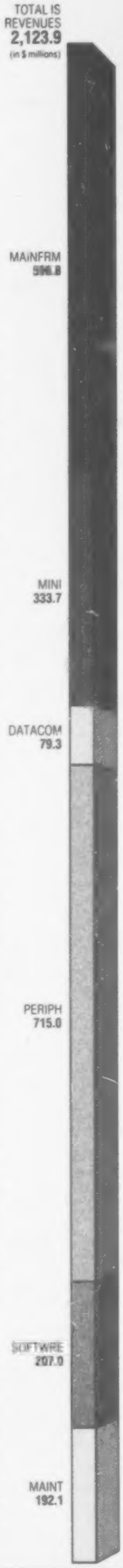
Company files at Xerox headquarters are stored on IBM mainframes. Managers download information to pcs using DECnet. Xerox isn't the least bit bashful about using other companies' systems because it only serves to underscore the fact that Xerox is no longer in the general purpose computer business. Since 1986, it has devoted its energies to document processing, a catchall office automation category that encompasses almost any activity in which information is put on paper. By the 1990s, Xerox feels this will be a vast market including almost every kind of firm, from brokerage houses that produce research reports, to publishers and public relations firms that churn out paper for a living.

Xerox products cover the entire publishing spectrum, from pc software to dedicated systems complete with scanners, workstations, specialized software, LANs, and high-speed printers. So far, expectations are running ahead of reality. Xerox's Ventura Publisher is a clear winner, the market leader among desktop publishing programs for the IBM PC environment. On the other hand, Xerox's larger proprietary systems have yet to score clear-cut market victories and have spawned little in the way of third-party software development.

Last year, sensing a problem in the making, Xerox announced its decision to go with two emerging industry standards: the Sun Microsystems SPARC microprocessor and the Sun/AT&T standard Unix. By licensing the basic platform technology, Xerox hopes to cut development costs and introduce new products more quickly. Products based on the new standards won't hit the market before 1990.

Xerox's total IS business was up 15% in 1987 to $2.4 billion. Total company revenues grew 15% to $14.9 billion, with net income increasing 24% to $578 million. Xerox says sales of its IS products were particularly good in Europe, thanks partly to the falling dollar. A hint of the kind of document processing business Xerox wants in the future was the $10 million contract it received in January from the Air Force for an automated publishing system to produce manuals and forms.

In 1987, Xerox increased its stake in financial services with the $110 million acquisition of Furman Selz Holding Corp., a New York-based research, brokerage, and investment banking firm. Financial services had been a weak spot on the Xerox balance sheet, but it proved to be the most profitable segment of the company last year, accounting for a little under a third of total revenues, but producing nearly half of Xerox's net income.



20

STC PLC

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STC's ceo Arthur Walsh had every reason to smile when he presented his company's 1987 results. STC has gone from a loss two years ago to the blackest of black inks. While total revenues climbed modestly to £2.1 billion ($3.38 billion) from £1.9 billion ($2.83 billion), STC is now more profitable than ever before: net income rose to £135.2 million ($221.1 million) from £103.1 million ($151.2 million).

It's good news for Northern Telecom, too. Northern Telecom now owns 27½% of STC, bought from the company's original owner, ITT. Only a tie-up between STC's IS subsidiary ICL and Japanese mainframer Fujitsu prevented Northern Telecom from buying STC lock, stock, and barrel.

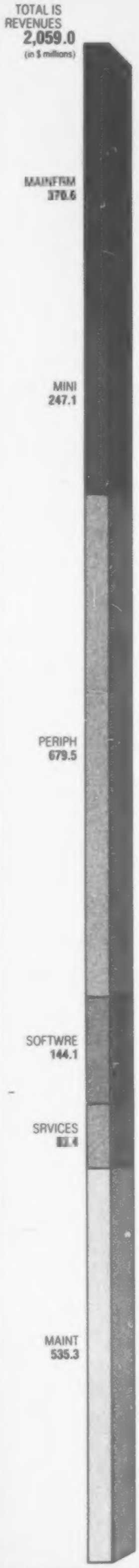
The mainstay of STC is ICL, the U.K.'s largest computer firm. It saw revenues grow to £1.29 billion ($2.1 billion) from £1.19 billion ($1.7 billion). Sales of its VME operating system—the U.K.'s most popular OS, ahead of IBM's—bounced up 30% during 1987. Much of the new VME business has been with customers upgrading from smaller and incompatible ME29 systems. ICL has struggled to find new users for Series 39 machines on which VME runs. Despite this, of the 700 VME systems sold since its launch in 1985, 450 were shipped last year.

Plans are for ICL to keep the pressure on in the mainframe business, which accounts for 55% of its revenues. The company will bring out a top-end mainframe this year, codenamed Essex.

The accent in the 1987 balance sheet was firmly on the home market, in which ICL is increasingly confined. The company is pinning its hopes for European expansion on Unix and low-end machines such as the U.S.-designed Clan and its own DRS networked office machine. Currency switchbacks are blamed for some of the disappointing overseas performance in 1987, now down to 35% of total revenues.

Meanwhile, STC is in a better position to meet such setbacks. Last year there was the possibility of a takeover bid for STC. This year it is STC that is likely to do the buying: U.K. electronics conglomerate Plessey's defense business is high on the shopping list.

While this business is heavily U.K.-based, STC is determined to break its British bias, and a new strategy aims at the creation of a truly pan-European company by the magic year of 1992. ICL has made these noises before, but, with its healthiest balance sheet in years and Northern Telecom's European network, it could have sufficient backing to make it work this time.



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HONEYWELL BULL INC.

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This was year one of independence. The apron strings were snipped on March 27 and Honeywell Bull struck out to forge its own way in the world. No longer the ancillary interest of defense giant Honeywell Inc., here was a company that, finally, could say it had but one focus: computers.

It was born out of the mingled interests of former parent Honeywell Inc., which retains a 42.5% stake, France's Groupe Bull, which holds an interest of equal size, and Japan's NEC Corp., a 15% stake holder. But Honeywell Bull sought to shape a new, single identity for itself.

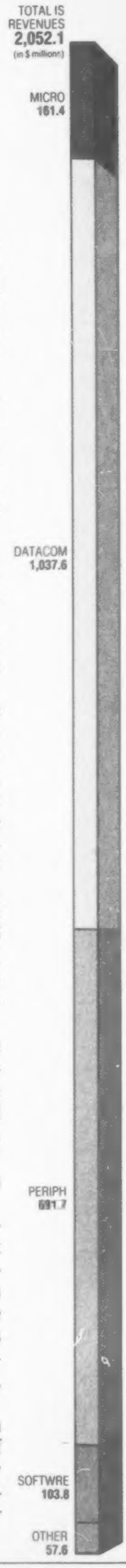
Initially setting up headquarters in Minneapolis, the company continued to reduce employment and trim excess capacity. It closed a Phoenix manufacturing operation, consolidated multiple Massachusetts offices, and announced that corporate headquarters would be moved to Massachusetts.

For users, there was an immediate pledge that similar consolidations would not be repeated within the company's multiple product lines: it promised users a gradual, painless evolution. Such efforts were borne out with the unveiling of common software such as the Oracle database and Mantis programming language for the company's DPS 6 Plus, DPS 7000, and DPS 8000 product lines. Successor models to the DPS 7 and DPS 8 were released along with new versions of the DPS 6 Plus minicomputer. The company pledged that the three lines would evolve using common CMOS technology as well as a shared family of peripherals.

Relationships with Groupe Bull were clarified. The two companies agreed to coordinate Unix development activities, which have been handled separately by Groupe Bull and Honeywell d'Italia on behalf of Honeywell Inc. The coordination aims to meld the companies' presently separate Unix lines, resulting in a single common family of Unix systems.

Strategically, Honeywell Bull's direction emerged largely unchanged. President Jerome Meyer's revamping of the sales organization brought new blood to the company's management ranks. It left undisturbed the company's focus on those markets where its systems traditionally have been favored: government, telecommunications, manufacturing, and health care.

By the year's end, Meyer could claim early success. The company earned a profit of $17.4 million on revenues that were up nearly 8% to $2.06 billion, strong results for an operation that in 1986 had made no profit at all for its parent.



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ALCATEL NV

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1050 Brussels, Belgium
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The largest company to make its debut on the DATAMATION 100 this year is Alcatel NV, the new, Brussels-based company formed when the computer and data communications businesses of ITT and Compagnie Générale d'Electricité were merged on Dec. 30, 1986. CGE owns 56.3% of Alcatel, while ITT retains 37%.

The deal created the second largest telecom equipment company in the world, after AT&T. In the U.S., Alcatel is perhaps best known for its terminal business.

As part of the restructuring, CGE disposed of its two major computer subsidiaries during 1987, both of which are among the largest software and services firms in France. The larger of them, Général de Service Informatique (GSI), was bought by its own employees, while the other, Société d'Études des Systems d'Automation (SESA), in which CGE had only a controlling 51% interest, was acquired by Cap Gemini Sogeti, which already had a 42% stake.

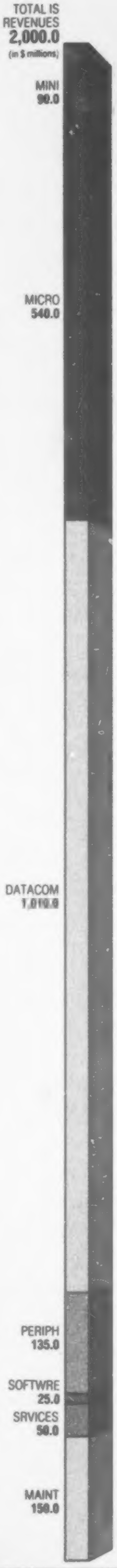
Alcatel NV, which is registered in the Netherlands, produces its accounts in European Currency Units (ECUs). Its IS and datacom revenues in 1987 totaled ECU1.78 billion ($2.05 billion), a slight increase in local currency terms from the estimated consolidated 1986 figure of ECU1.73 billion ($1.69 billion).

About half of the 1987 total, ECU900 million ($1.04 million), came from datacom equipment sales, while a further 33.7%, ECU600 million ($691.7 million), was derived from peripherals. Minis and micros generated revenues of ECU140 million ($161.4 million), and software brought in ECU90 million ($103.8 million).

Europe is far and away the company's biggest market. It accounts for 62.8% of 1987 sales, worth ECU1.01 billion ($1.27 billion). North America contributed exactly half as much—ECU550 million ($634 million)—while the company's revenues from the Asia/Pacific region amounted to about ECU90 million ($104 million).

On its home turf, Alcatel was predictably awarded the contract to supply its E10 switching system as the central core of France's trial ISDN, which started up in the north of the country toward the end of 1987. The system will be extended to the Paris region during 1988.

Alcatel's parent CGE itself underwent a change of status in 1987 when the French government privatized the firm. The company had been nationalized by the country's Socialist government in 1982. The transformation took place in May, well before the worldwide stock market crash, and placed a value on CGE of FF20.6 billion ($3.43 billion).



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AT&T CORP.

550 Madison Ave.
New York, NY 10022
(212) 605-5500

During 1987, AT&T seemed to have turned several corners in its drive to complete the transformation begun with divestiture. AT&T chairman James Olson felt able to amend his famous observation that the company was on the right road but in the wrong lane: "We're still traveling down the right road but now we're also in the right lane—the fast lane." While AT&T's profits were in danger of a speeding ticket, its revenues appeared to be stuck in the breakdown lane.

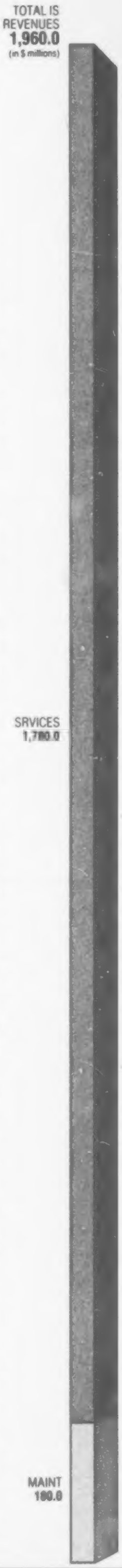
So far, 1988 has delivered bad news. All of AT&T's planning and reorganizing couldn't have anticipated Olson's sudden death from cancer in April. Within a week of his death, president and good friend Robert Allen was named as his successor. In a move widely interpreted as revealing strains in the AT&T-Olivetti relationship, Vittorio Cassoni announced he would leave AT&T and return to his old haunts at Olivetti as managing director. Senior vp and cfo Robert Kavner replaces him as president of the Data Systems Group.

For 1987, total operating revenues stood at $33.6 billion, down slightly from the $34 billion of the previous year. But AT&T accomplished its top goal of turning around profits. Net income for 1987 was slightly more than $2 billion, or $1.88 per share. This is a big improvement over the $139 million, or 5 cents per share, reported the preceding year. Continuing its downsizing, AT&T's work force decreased by 8,000 in 1987 to 303,000.

Telecom services, which account for half of AT&T's revenue stream, increased by almost $700 million, to $17.5 billion, despite a 16% reduction in prices. While AT&T execs say IS sales were flat for the year, DATAMATION estimates that revenues from sales of computer products and PBXs actually fell slightly, to about $2 billion. And despite the rumors, AT&T said it's in the computer business for the long haul. Among new systems it now has to sell are the AT&T 6386 WorkGroup System, a pc based on the 32-bit 80386 chip, and the AT&T 3B4000, positioned at the high end of the 3B minicomputer line.

AT&T also closed ranks with a computer industry high-flyer, Sun Microsystems Inc. AT&T will use Sun's new SPARC chip in future systems and the two are working to further standardize Unix. In January 1988, AT&T agreed to purchase as much as 20% of Sun in the next three years.

Digital PBX products got a boost with new versions of the System 85 and System 75 families. But analysts say that despite a leadership position in the PBX market, cutthroat pricing meant break-even financials at best.



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TRW INC.

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(216) 291-7000

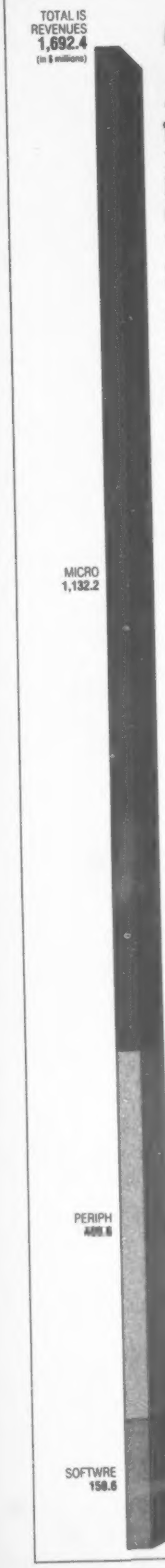
TRW, which was founded in 1901 to make screws and bolts, is pushing a new image of itself as a high-tech firm that just happens to make auto and truck parts. It has deemphasized industrial and energy activities, saying they now account for less than 5% of sales. Meanwhile, TRW's revenues in information systems and services grew to $1.96 billion, a solid 20.6% jump. Corporate revenues for 1987 were $6.82 billion, up from $6.04 billion the year before. Earnings were $243 million.

At the core of its information systems group is its credit reporting service, TRW Credit Data. Last year, TRW heavily promoted its Credentials service, which allows consumers to prequalify for credit by filling out a master credit application for quick reference as needed. This year, TRW Credit Data acquired a Dallas-based credit reporting service, Chilton Corp., from Borg Warner Corp., thereby strengthening its position in the Midwest.

Military-related activities still account for much of TRW's information systems revenues, despite the early-1988 loss of "secret" contracts, which led to layoffs of some 3,000 Southern California employees. The company has a number of Strategic Defense Initiative contracts, including several in the area of battle management/command, control, and communications. It has several Ada language contracts, including reprogramming AWIS, the Army's worldwide communications system, and upgrading the Air Force's Command Center Processing and Display System (CCPDS-R). (Revelations early last year that the company had overcharged on some military contracts did not seem to affect its government business, perhaps because TRW blew the whistle on itself.)

The company expanded its third-party service and maintenance organization to provide service for more than 1,500 different kinds of electronic gear. TRW's Information Networks Div., which develops and installs specialized local area networks and designs secure communications systems, is beefing up its off-the-shelf LAN product line. Recently, it added a local net bridge and IBM PC-based Transmission Control Protocol/Internet Protocol (TCP/IP) software.

Chairman and chief executive Ruben Mettler created a special unit to speed up development of commercial uses for information handling technology developed by TRW under government contracts. Later this year, Mettler will hand over his jobs to president and chief operating officer Joseph T. Gorman, but little change in direction is expected: the two have worked closely since 1980.



25

TANDY CORP.

1800 One Tandy Center
Fort Worth, TX 76102
(817) 390-3700

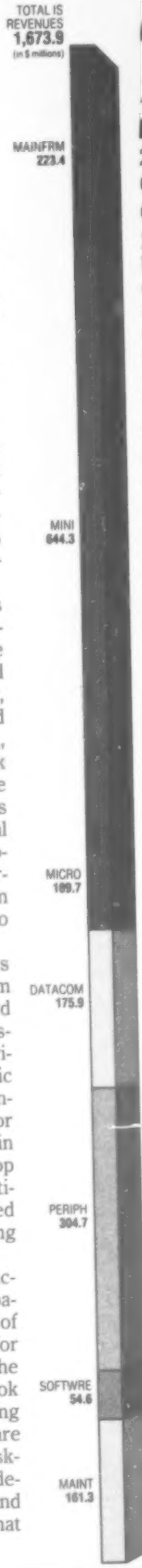
While many an oil rig sits inactive just outside of Tandy Corp.'s hometown of Fort Worth, Tandy has been anything but idle in the past year, moving quickly to introduce higher-performance machines that still incorporate the company's well-known price attributes. Sales of Tandy's computer products grew a modest 8.5% in 1987 to $1.7 billion.

Last year marked the 10th anniversary of the company's first home computer, the first product the company had ever sold that cost more than $500. A redesign of the company's Radio Shack chain of consumer electronics stores has helped revamp the company's image, while maintaining the lure of its attractive pricing.

Tandy has eyed the juicy business market for some time and continues to introduce products aimed at appealing to corporate America. In August, the company introduced its first computer to use 80386 technology, the Tandy 4000, geared for the education and business markets. In another move upmarket, laser printers made their debut at Radio Shack in the form of the Tandy LP 1000. At the same time, the former gadget and electronic parts retailer spiffed up its Tandy 3000 personal computers and entered the PC-compatible laptop market with the Tandy 1400 LT. Not ignoring the home consumer and education markets, Tandy also improved and added to its bread-and-butter Tandy 1000 line.

In building its computers, Tandy has direct control of just about everything, from injection molding of cabinets to circuit board manufacture. In 1987, the company transferred production of several products previously manufactured overseas to domestic manufacturing plants. In November, the company announced it will bring home its Color Computer 3, which had been manufactured in South Korea. Henceforth, all Tandy desktop computer production will take place domestically. To meet demand, the company initiated construction on a computer manufacturing plant in Fort Worth.

In March 1988, Tandy expanded by acquisition—an unusual move for the company—when it purchased Grid Systems Corp. of Fremont, Calif., a manufacturer of laptops for the corporate and government market. On the technical front, Tandy has continued to look after its so-called low-end market by licensing (for free) its DeskMate software to software developers. The company hopes that DeskMate, similar to Microsoft's Windows but designed for machines that use Intel 8086 and 8088 chips, will become a standard in that product range.



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MITSUBISHI ELECTRIC CORP.

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Mitsubishi Electric (MELCO) is not a high-visibility player in the Japanese IS world. Consumer electronics products account for 26% of its sales, and the company is a major defense electronics supplier through its ties with Mitsubishi Heavy Industries, a supplier of fighter and other aircraft. Much of MELCO's IS production is for oem customers; products sold under its own label have not made much of a name for themselves. Still, IS revenues in 1987 increased 6.8% to ¥242.1 billion ($1.7 billion).

One of its more interesting developments last year was the July announcement of an IBM-compatible mainframe, called the MPS4. MELCO's reentry into the pcm market sparked great interest in Japanese IS circles, and had been expected to have a big impact on the domestic mainframe industry. MELCO was one of the original manufacturers paired off by the Ministry of International Trade and Industry to improve homegrown mainframe performance against then-leader IBM Japan. The duos were Fujitsu and Hitachi, NEC and Toshiba, and MELCO and Oki. Toshiba and Oki pulled out fairly early, while Fujitsu and Hitachi prospered with IBM-compatible strategies, as did NEC in its position as the only domestic alternative to the pcms.

Although MELCO tried to follow Fujitsu and Hitachi into the pcm market, its attempts were brought to a halt in 1982 by the famous Silicon Valley industrial espionage incident.

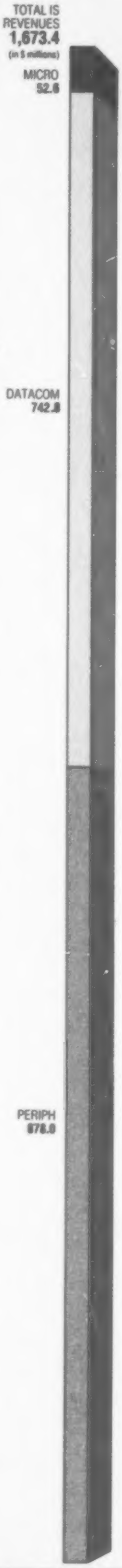
So far, the new mainframe has made little impact, and sales have been negligible.

While MELCO's traditional business of supplying cpus and peripherals to Unisys has proven more lucrative, its value has shrunk because of the falling value of dollar-based revenues.

Superminis from MELCO have achieved popularity among scientific and university users, who find them to be good, cheap hardware. Since these users write most of their own software, the lack of other software for the systems has not hurt mini sales, which rose an estimated 16.5% in 1987.

Micro sales dropped more than 28% from a slip in oem shipments to the U.S. resulting from punitive semiconductor tariffs. Other products include hard disk and 3½-inch floppy drives, monitors, and printers.

Semiconductors were a brighter spot. MELCO has established itself as a leader in the 1Mb DRAM race, and since the semiconductor agreement between Japan and the U.S. virtually guarantees a profitable minimum price level on memory chips, the company's modern Saijo plant has become a real money-maker.



27

CANON INC.

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Shinjuku-ku, Tokyo 163, Japan
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The enormous success of laser printers and the growing recognition of facsimile machines as data communications equipment have shot Canon into the IS big time. When Canon's specialty, the manufacture of 35mm cameras, matured to the point that it was officially designated a "sunset industry" by the Ministry of International Trade and Industry (MITI), Canon obligingly diversified into faster-growing fields. In 1987, Canon's sales of pcs, printers, and facsimile machines grew 44.5% to ¥242 billion ($1.67 billion), while profits grew 23.4% to ¥13.2 billion ($91.6 million).

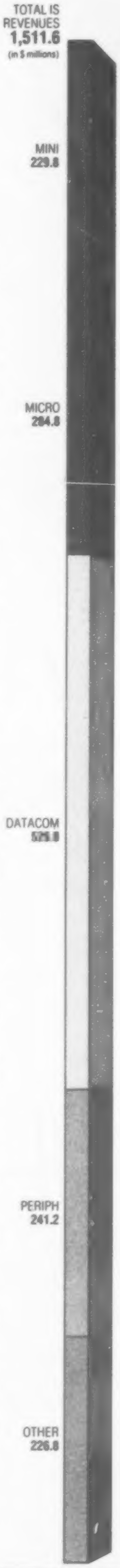
Canon's new businesses are based on past expertise. Taking advantage of optical skills gained from years of making top-quality camera lenses, Canon became a top Japanese manufacturer of devices for semiconductor production. Copiers became a huge moneymaker, accounting for about 33% of sales.

It was a logical step to the commercialization of the revolutionary laser printer. Canon supplies oem machines to Apple and Hewlett-Packard, and its engine powers the products of other manufacturers. Its latest move has been the introduction of bubble-jet printers, an improvement over ink-jet technology that permits relatively cheap machines to put out high-quality copies; the technology has been licensed to Hewlett-Packard.

With an export ratio of 74%, Canon has been hit hard by the decreased value of the dollar. One now-standard step has been to increase production in five overseas plants. Sales of its IS products in the U.S. have been relatively unhurt because so few U.S. competitors build facsimiles and laser printers. Still, Canon will begin laser printer production at a copier plant in Virginia this year. A subsidiary in France also will build laser printers.

Canon tied up with some big names overseas in 1987. It formed a joint laser printer and copier venture with Olivetti, called Olivetti-Canon Italy. Software was the subject of a deal in which Canon agreed to license Phoenix Technologies Ltd.'s page description language software for its laser printers.

Late in the year, Canon reached an agreement with Siemens to supply laser and bubble-jet printers and high-resolution facsimiles to the West German electrical equipment maker. Canon also agreed to import PBXs from Siemens' U.S. subsidiary. In another significant import agreement, Canon said it would purchase integrated circuits from Intel for some high-speed copiers; it also buys ICs from National Semiconductor, Motorola, and Texas Instruments. Canon hoped the move would help ease U.S.-Japan trade friction.



28

TELEFONAKTIEBOLAGET LM ERICSSON

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Stockholm, Sweden
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After years of disastrous losses, LM Ericsson's IS division, Ericsson Information Systems (EIS), finally broke even in 1987. Not good enough, said the parent company, and early this year the Data Systems Div. was sold to Finland's Nokia. The deal created a major force in the Scandinavian computer industry, Nokia Data Systems, which aims to be Europe's premier workstation supplier by 1992. Ericsson retains a 20% stake in the venture.

Nokia gets a division that has been turned around by EIS president Stig Larsson. In recent years, major cost-cutting has taken a toll on staffing levels, distribution links, and R&D projects. Last year alone, the EIS operation reduced its work force by 2,300. Those cutbacks allowed the division to pull back from its losses in 1986 and show a small profit on its 1987 sales of Skr9.58 billion ($1.5 billion).

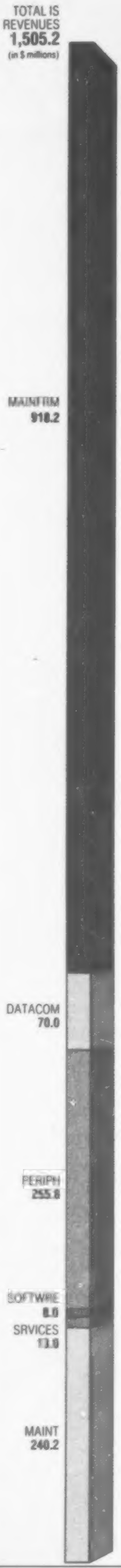
While Ericsson had strength in minis and micros, its IS sales came largely from data communications systems. Almost 90% of the 1987 revenues were generated in Europe, with much of the business confined to Scandinavia.

Before the Nokia sellout, Ericsson had shed its office equipment business—including the long-established Facit terminal operation—by selling it to Norwegian firm Design Function in October 1987. Among the operations sold to Nokia was the EIS Workstation Systems Div., offering mainly Alfaskop IBM-compatible terminals and pcs.

Other products emerging from EIS last year were the 7160 low-cost laser printer, the SNS II networking support package running on its System 2500 range of minis, a low-end version of its MD 110 PBX, LAN products such as the Personal Office System 61 file server, and an optical multiplexor.

Ericsson's focus for the future will be on its telecom business. It hasn't forgotten its pledge to develop networking products that support voice and data, the motivation behind the company's tie-up early last September with IBM. By combining Ericsson's central office switching expertise with IBM's knowledge of databases and data networking, the firms aim to develop intelligent network services based on Ericsson switching systems.

Other collaborative efforts in the IS sector are in jeopardy, however. An agreement with Digital Equipment Corp. to develop banking systems, for example, was to have resulted in a host of products by the end of last year. In the wake of the Nokia sale, the deal is being renegotiated. Ericsson's other links with U.S. companies are also under review.



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AMDAHL CORP.

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During 1987, Amdahl Corp. began to ship its latest plug-compatible mainframe computer in volume and faced few new product challenges from IBM. The result was spectacular growth, pushing Amdahl beyond $1 billion in annual sales, well on its way to the $2 billion mark. Its revenues grew 55.8% to $1.51 billion. Earnings were up 249.3% to $146 million.

Not bad for a company that just a couple of years ago was mired in depressed earnings, with a principal product line that was plagued with performance shortfalls and postponements. Amdahl finally put to rest the question that has always hounded makers of IBM plug-compatible equipment, namely, can they stay compatible and stay competitive with IBM.

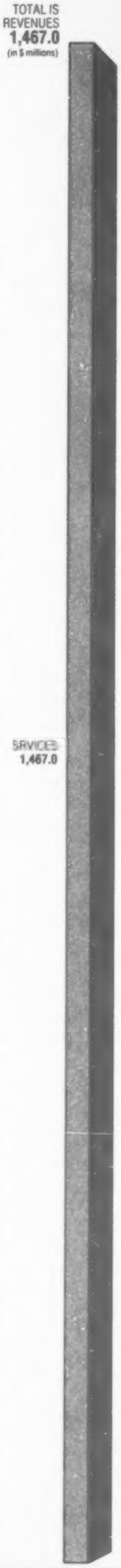
Leading the way was Amdahl's 5890 mainframe product line, which competes with IBM's 3090. By the end of 1987, Amdahl had sold and installed an estimated 225 copies of the IBM-compatible system, making the 5890 the fastest starting Amdahl mainframe to date. It accounted for over 85% of Amdahl's systems shipments in 1987. Analysts predict Amdahl will sell over 300 systems in 1988, and the vast majority of those will be 5890s.

Amdahl upgraded the 5890 line during 1987, keeping it competitive with the 3090 when IBM came out with the so-called E models. As the year ended, Amdahl began to ship the larger, multiprocessor versions of the 5890 system.

Amdahl upgraded its family of front-end communications processors for mainframes by introducing the 4725 series. The system represents a performance increase of about 80% over Amdahl's previous communications processor. Amdahl also improved its supercomputers, increasing their peak performance in an attempt to boost what has been a disappointing product line.

On the software side, Amdahl made a major commitment to Unix, signing an agreement with Unix innovator Sun Microsystems Inc., Mountain View, Calif., and discontinuing its own Aspen operating system development. Sun and Amdahl said they will merge components of their respective Unix offerings and develop a joint marketing program including Amdahl's mainframes and Sun's workstations.

Amdahl expects major competitive challenges ahead: IBM begins shipping its new operating system, MVS/ESA, in August, and Amdahl will be under pressure to make its mainframes ESA compatible. Also, IBM is expected later this year to begin shipping the so-called F models of its 3090, featuring performance enhancements of up to 25%.



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AUTOMATIC DATA PROCESSING INC.

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(201) 994-5000

ADP Inc. chalked up its 38th consecutive year of increased revenues and earnings: sales in 1987 grew 13% to $1.47 billion, while profits vaulted to $149.8 million.

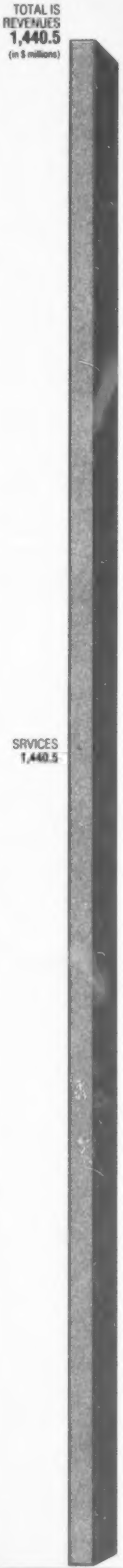
The big event for ADP in 1987 was the big event for the rest of the economy—the Wall Street crash in October. The Brokerage Information Services Group, ADP's second-largest business, was in the eye of the Oct. 19th order processing storm. The volume of orders recorded that hectic day, and in the days following, tested ADP's computer capacity. "We did very well, but with tremendous strain," says Arthur F. Weinbach, senior vice president of administration and finance. "There were certainly glitches that occurred."

ADP began adding processing power. This year, it will make a $100 million capital investment in new computer and communications equipment. The company also began moving its primary processing facilities from New York to Journal Square in New Jersey.

Earlier in 1987, ADP reorganized the brokerage group along functional lines, combining its previously separate front- and back-office operations in order to present "one face" to customers, according to Weinbach.

ADP secured a major brokerage contract in 1987 with Shearson Lehman for IBM PS/2-based front-office services. This follows contracts with Merrill Lynch and Prudential Bache in 1986. The Brokerage Information Services Group had an approximate growth rate of 23% in '87, about the same as it had in 1986. ADP's Employer Services unit, the company's payroll and tax filing operation (its oldest and largest business) continued to account for about 45% of ADP's total revenues. Dealer Services, about 10% of ADP's overall business, booked "mid-teen" growth rates, Weinbach says; new competition, in the form of GM's Electronic Data Systems, entered the market in 1987.

Collision Estimating had a growth rate of over 25%, but the revenue contribution of ADP's Network Services unit, in Ann Arbor, Mich., continued to decline. ADP has weighed scaling this business back; it represents under $50 million in revenues, and ADP is writing off all fixed costs and refraining from investment in new products. Nevertheless, Network Services has the highest profit margins of any business within ADP, Weinbach says. Other activities last year included the redemption in February of a $100 million convertible debenture offering, the expansion of the corporate headquarters to 450,000 square feet, and the addition of about 2,000 employees to bring total employment to about 22,000.



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ELECTRONIC DATA SYSTEMS

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(214) 661-6000

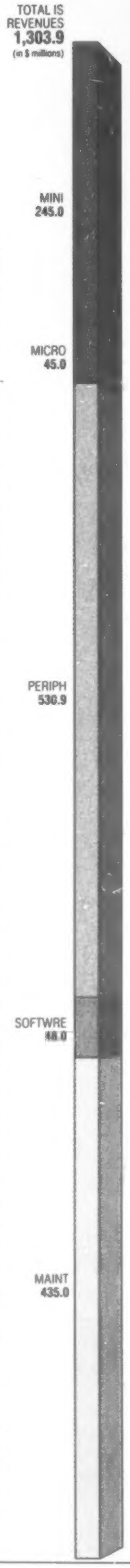
As it seems to do every year, General Motors subsidiary Electronic Data Systems smashed its previous records in revenue, net income, and earnings per share. Its $1.44 billion in sales were up 28% over 1986, which marked the first time EDS had surpassed $1 billion in non-GM income. (IS revenues in the DATAMATION 100 do not include revenues from sales by one unit of a company to another.) GM paid EDS $2.88 billion last year, a 9.8% decrease from 1986 primarily due to the expected completion of two major, one-time projects for GM.

GM business still was almost two thirds of total operating revenues, too high to please EDS, which is aiming for a 50-50 GM/non-GM split. "We should be doing 35% of our business from non-GM sources by the end of the first half of the year," says Gary Fernandes, EDS's senior vice president, "and I'll be disappointed if we don't get to 40% by the end of the year."

EDS hit some grand slams in its favorite ballpark, the government systems integration arena. It won a nine-and-a-half-year contract with the U.S. Army to implement and operate Project 80X, the Army's primary large-scale personnel management system. Another EDS ship came in with a 12-year systems integration contract to manage the Navy Stock Point ADP Replacement (SPAR) project.

"Those are examples of our drive to expand our share in our traditional markets," Fernandes says. "I feel like we invented systems integration. But the trend is changing. The real competition is no longer in-house dp departments. Now, large, technologically rich, well-financed companies with deep pockets are getting into the market. IBM's entry is a direct result of losing major contracts to us. They lost Viable [a worldwide military communications system contract] to us when they had the installed base. So now all my time is focused on the deep-pocket guys."

They're probably casting more than a casual glance at EDS, too, since the company doesn't dine only from the government trough. It connected last year on four long-term state health insurance claims processing contracts and four major commercial insurance and financial contracts. GM's Truck and Bus Group also kicked in a $950 million, five-year deal for facilities management and communications services. That deal went down after EDS was the star integrator of GM's light-body truck project. The production process at GM's Pontiac, Mich., plant was the first to rely completely on the Manufacturing Automation Protocol (MAP), GM's pet system for connecting heterogeneous computers.



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DATA GENERAL CORP.

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Westboro, MA 01580
(617) 366-8911

Well into a third year of lackluster sales and faced with a second year of losses, Data General Corp. in 1987 was a company redolent with retreat. It pulled back from attempts to establish itself in large commercial IS shops, unveiled few processors, and watched the continuation of an exodus of former IBM executives who had plotted its end-user strategy.

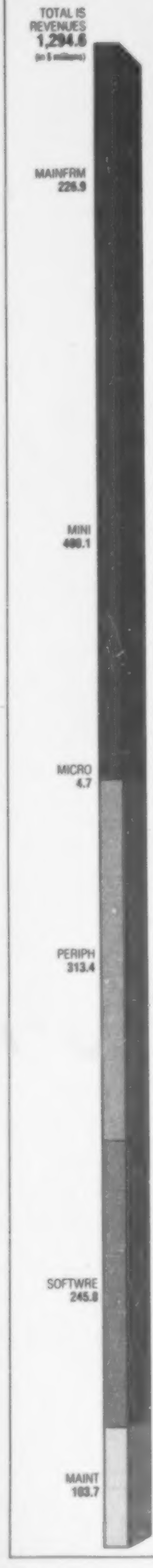
After abandoning costly head-to-head competition with IBM and Digital Equipment Corp., DG sought to recover by turning to smaller commercial IS shops and value-added resellers. Scrambling to sign up resellers and other applications developers, DG sought relationships with those who could make near-term contributions to its sales.

As part of that effort, Ward D. MacKenzie, a onetime DEC reseller executive, was brought in to lead DG's reseller division. His arrival coincided with the departure of the executives who had formulated the company's end-user strategy—including key end-user tactician Robert C. Miller—and was symbolic of DG's change of heart.

The reseller strategy countered disappointing sales to the larger end users whose affection for the Comprehensive Electronic Office (CEO) office automation software had previously swelled DG's customer ranks. And even though sales were flat at $1.3 billion compared to $1.28 billion the year earlier, losses multiplied. Write-offs associated with consolidation of some manufacturing plants contributed to a $111.3 million loss for the year ended Dec. 26, 1987, dwarfing the previous year's loss of $26.8 million.

The losses had great impact. Major additions to the company's Eclipse/MV computer family were noticeably absent during the year. The only processors unveiled were specially designed versions of existing computers packaged for resellers. These rack mounted versions of the low-end MV/2000 and mid-range MV/7800 bolstered the new reseller direction but did nothing for margins.

Although the reseller emphasis grew throughout the year, an October agreement with Japan's Nippon Telegraph and Telephone Corp. (NTT) suggested that Data General views the reseller focus as a phase for resting and regrouping. NTT agreed to help fund the development of a high-speed data, voice, and image transmission system. The agreement promises to open NTT's Japanese network customers to Data General's computers and applications. More than a simple development pact, the agreement signaled that by 1989, DG again will confront its larger brethren on the value-added network plane.



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NIPPON UNIVAC KAISHA LTD.

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Tokyo 107, Japan
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After months of denials followed by a year of negotiations, the official announcement was made on Dec. 3: Nippon Univac and the Japanese Burroughs subsidiary would become one on April 1, 1988. The new entity is called Nihon Unisys, and has some 7,000 employees. Its headquarters will be the Akasaka building where Nippon Univac has resided. Mitsui & Co. will own 34.2% of the new company, the same portion it held of Nippon Univac; Unisys will have another 34.2%, and the rest will be in the market.

On its own in 1987, Nippon Univac's revenues were up 12.7% to ¥187.2 billion ($1.3 billion). Riding the success of 1100/90 sales, mainframes showed a strong 15% increase. Among the biggest markets for the machines were banks (many of which were installing third generation on-line systems) and securities companies.

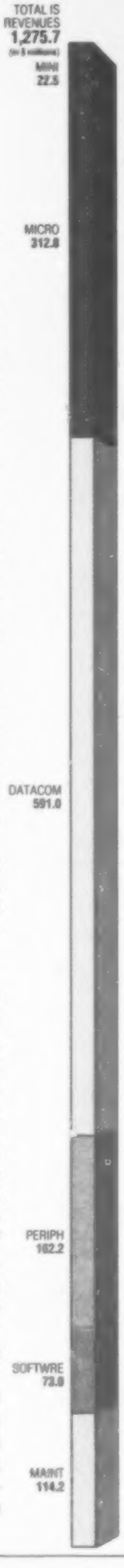
Power companies were also good customers. Flush with record profits—the appreciating yen made imported raw materials very cheap—many invested in automated systems for both their power distribution and their office and billing procedures. Tokyo Electric Power, for example, bought about half a dozen 1100/90s.

Airline deregulation helped another big sale. All Nippon Airways, free to expand its flight network overseas, purchased several mainframes for its flight control and seat reservation system.

The Swift 2200/200 midsize machine, introduced in late 1986, proved a hit in 1987: 350 systems were sold, a full 45% of them to new customers. According to NUK officials, the easy-to-use MAPPER 4GL software product was the biggest selling point for the systems.

The merger of the parents into Unisys did not have any negative effect on NUK in 1987, according to officials. Sales did not decrease as some observers had predicted. The belated merger of the Japanese branches is expected to be beneficial. For example, where Nippon Univac was weak at the bottom end of its product line, micros from the former Burroughs side of the family will fill in some of the gaps. On the mainframe end of the scale, Nippon Unisys is expected to have some new large-scale products to spice sales beginning this fall.

As another bonus from the merger, the newly combined Japanese company will have a base of around 3,500 software engineers, a valuable resource in a country where most customers try to write all of their own applications and expect vendor programmers to make house calls to help with any problems.



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RICOH CO. LTD.

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Minato-ku, Tokyo 107, Japan
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Ricoh offers a refreshing respite from the tales of woe heard in virtually every corner of the Japanese electronics industry. While the high yen has decreased both the volume and the value of exports for most Japanese manufacturers, Ricoh's overseas sales are prospering. On the strength of impressive gains in facsimile machines and laser printers, revenues were up an estimated 7.5%, with the IS portion up more than 17% to ¥184.49 billion ($1.27 billion). Its overall export ratio increased a full 5%, to 36%.

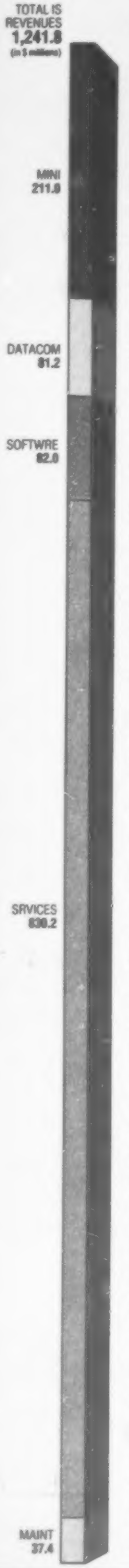
The appreciating yen doesn't hurt fax or laser printer exports as much as other products: the only major manufacturers are Japanese firms laboring under similar handicaps. On the other hand, the Japanese fax market is moving downscale, as machines small and cheap enough to enter the home consumer market make an appearance. Because the domestic sales network that brought Ricoh such success in copiers is aimed largely at business users, expanding into the consumer-oriented fax market may be tough.

The outlook for computers is less bright. Early in the year, on the export side, the company stopped producing cpus for Convergent Technologies Inc. of the U.S. because of the high yen. At home, the company has never been a major player, despite attempts to sell foreign products, such as AT&T 3B minicomputers and Japanese versions of IBM's PS/2. Neither product has had much impact.

Like many of its competitors, Ricoh is attempting to sell itself as a supplier of comprehensive systems for the office, anticipating the day when Japanese companies get as serious about automating offices as they have been about factories. The AT&T and IBM computers were attempts to plug some of the holes, but Ricoh lacks the software and systems expertise needed to have a major effect.

Copiers remain the solid center of Ricoh's business, although at 48% of sales last year, their contribution has decreased somewhat from the previous year. Other products include cameras, optical equipment, and semiconductors, such as application-specific integrated circuits. The recovery of the semiconductor market also has contributed to the company's revenue and profit health.

Ricoh's move to overseas production is less pronounced than that of its competitors. In fact, a new plant at home, in Tottori Prefecture, is scheduled to begin operating in October. A French plant started up last year, as did one in the U.K. In the U.S., local production and R&D arms were absorbed by Ricoh Corp., based in West Caldwell, N.J.



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MCDONNELL DOUGLAS CORP.

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The good news at McDonnell Douglas Information Systems Co. (ISC) is that there wasn't that much bad news. ISC's revenues rose 4.4% to $1.24 billion from $1.19 billion. Losses decreased 39% to $42.3 million from $69.7 million. That loss came despite a $44.3 million gain from the sale of several investments, including a French computer services firm. There were also $36 million in write-offs of "businesses that were no longer strategic," as the corporation delicately put it.

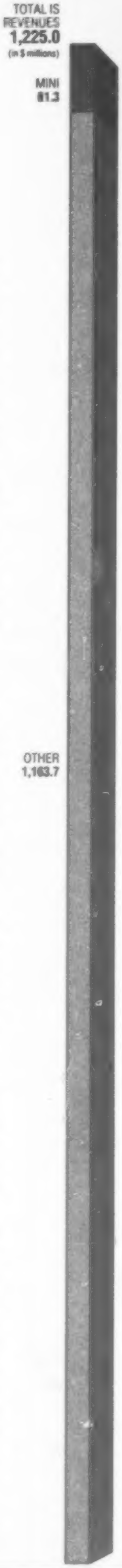
The ISC actually would have earned $46.9 million but for the continuing short-term amortization of the previous acquisitions of Microdata, a Southern California-based maker of small business systems, and Tymshare, the renowned provider of remote computing services. Amortization of these two investments splashed the balance sheet with $53.2 million in red ink.

The ink last year would have been blood red without McDonnell Douglas Information Systems International (ISI), which accounted for more than one quarter of ISC's revenues. ISI grew to $315.9 million in revenues last year from $157.7 million in 1985. ISI's presence is strongest in Britain, where it owns 10.9% of the midsize computer market.

McDonnell Douglas Corp., which is doing far better with combat aircraft, transport aircraft, and space systems and missiles than it is with information technology, rode a 4% revenues increase into a 13% earnings jump. Revenues rose to $13.3 billion from $12.8 billion, while earnings climbed to $313 million from $277.5 million. Earnings per share went to $7.75 from $6.86.

While the parent was waxing fat and happy over megabucks contracts, such as the one for the Navy's advanced tactical aircraft, the child aimed to become a lean, mean fighting machine. "In each business segment," explains Paul Weidenmann, corporate vice president, ISC finance, "we tried to identify the things on which the business was spending too much money, which weren't strategic, and which didn't have future profitability potential." Among the vanishing items were health information and network systems operations.

"That made it a difficult year, but it let us become much more tightly focused on the markets we belong in," Weidenmann says. "The computer systems sales force has been vertically reorganized. Our CAD/CAM business now focuses exclusively on the Unigraphics software. We're free of the useless distractions and peripheral businesses. Those moves have liberated us to do a better job where we can really compete."



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INSPECTORATE INTERNATIONAL LTD.

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CH-2000 Neuchatel 4, Switzerland
(41-38) 250228

A series of lightning takeover bids has propelled Swiss-based Inspectorate International into the top position in the European leasing business, and into the DATAMATION 100. Werner K. Rey, the financier who owns the company, has more than doubled Inspectorate's sales. Within two years of buying U.S. leasing firm Meridian, Deerfield, Ill., the company's Swiss management has added a clutch of other leasing, services, and data processing operations in Europe and the U.S. to its original inspection and quality control business.

The provision of inspectors to firms trading in commodities was once its core business, but the company has transformed itself into an information technology specialist. Of the SFr2.49 billion ($1.67 billion) sales it recorded last year, some SFr1.8 billion ($1.2 billion) came from its IS business. Both figures include the 1987 revenues of two major U.K. acquisitions—United Leasing plc and IBL.

The company has always had a finger in IS through its bureau and software operations. Inspectorate owns the Swiss company Automation Center International (ACI) in Wettingen, Switzerland. Applications running on ACI systems include the ZEK system of on-line credit checking for the Swiss banking fraternity. In the U.K., Inspectorate owns the service bureau UCC.

Inspectorate has moved into the pc business, distributing the Delta Gold system produced by Delta Computer Corp. The product is sold by Inspectorate Data Systems throughout Europe. Even Harrod's of London sells the machine.

A key plank in the expansion strategy has been the acquisition of underfinanced U.K. leasing firms. Last year, the company paid over SFr194.8 million ($130 million) to purchase IBL and United Leasing. These companies have been absorbed by Meridian International.

United Leasing owned Unilease, the third-largest U.S. leasing company. United Leasing's accounting methods for the treatment of the residual value of leased computers, long a matter of controversy in the British industry, have been brought in line with Meridian's more conservative approach. Audits of IBL, meanwhile, have shown discrepancies in the treatment of computers on lease.

Heretofore specializing in the IBM leasing market, Meridian is keen to diversify into Digital Equipment Corp. equipment. Meridian believes DEC will account for an increasing slice of the computer leasing market, and, this year, Meridian purchased U.K. DEC specialist Electronic Brokers, London.

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COMPAQ COMPUTER CORP.

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Compaq remains a top choice among corporate buyers faithful to MS/DOS and unseduced by IBM's new line of PS/2 machines: it posted sales of $1.2 billion in 1987, nearly double the previous year's figures. Compaq also broke its income record last year, netting $136.3 million, compared with $42.8 million in 1986. Company officials predict a growth rate between 20% and 30% in 1988.

Compaq's successful strategy consists primarily of a two-pronged offensive against IBM's much ballyhooed PS/2 computers and OS/2 operating system announced in April 1987. The company still has the MS/DOS party faithful snugly under its wing and is hoping to convince the rest of the world that Microsoft Corp.'s OS/2 operating system can work just fine with Compaq machines.

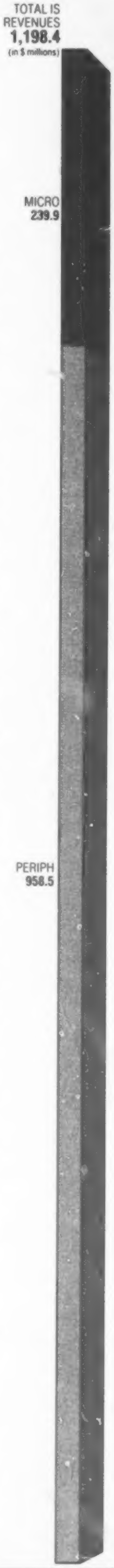
First, Compaq announced its Deskpro 386 in September, underscoring its commitment to the MS/DOS world, which was wary of being left high and dry when IBM began directing efforts to its new operating systems and machines. The announcement helped allay fears that Compaq was going to be vulnerable to cheap IBM-compatible clones: they were high performance and priced above the clones, demonstrating the company's confidence in its technology.

Compaq unleashed its second volley against IBM earlier this year when it gathered several top dogs from the software world to announce the company's release of OS/2 for its machines, thereby alleviating MIS worries that OS/2 would only work on IBM's new PS/2 machines equipped with Micro Channel Architecture. At the same time, Compaq officials broadly hinted that, if its customers so desired, it could produce a PS/2 clone utilizing Micro Channel Architecture.

The two new machines Compaq introduced in 1987 were the Compaq Deskpro 386/20, based on the Intel 20MHz 80386 microprocessor, and an 80386-based portable computer. Both speedy products are designed to keep Compaq at the high-profit, high end of the personal computer market.

A new portable from IBM this year seems almost a certainty, but Compaq's portables have been so well accepted that its grip on that market may be difficult to unclasp. Rumors of a laptop computer from Compaq continue to make the rounds.

For now, Compaq seems happy with the way things are going. A new manufacturing plant in Erskine, Scotland, along with a printed circuit board assembly plant in Singapore, should help alleviate the company's production problems this year.



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SEIKO EPSON CORP.

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Seiko Epson complimented NEC Corp. in 1987 by bringing out a set of pcs compatible with the top-selling NEC 9801 series of 16-bit pcs, the machines for which an estimated 90% of the pc software in Japan was written. The venture got off to a rocky start. Before the first machine was sold, NEC sued for violation of its BIOS copyright. The two companies reached an undisclosed financial settlement and the first desktop model was brought out in April; two models with improved cost performance were added in September, and a laptop version hit the streets in November. The company estimated it had sold 50,000 of the compatibles by the end of March 1988.

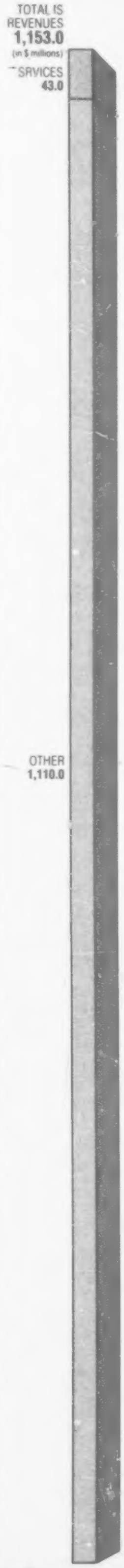
That was about the only bright spot in a trouble-filled year for the privately held corporation. Sorrow overtook the company on May 19 when its vigorous 55-year-old president, Ichiro Hattori, died of a heart attack during a golf tournament. Hattori, a relative of deceased company founder Kintaro Hattori, had engineered the 1985 merger of watchmaker Suwa Seiko and printer pioneer Epson into a $2 billion-plus high-tech company designed to cope in the increasingly hostile environment brought on by the high yen and growing protectionist sentiments abroad.

As a result of the punitive tariffs imposed because of Japanese violations of the semiconductor agreement, the company had to stop shipping its strong-selling Equity series of IBM-compatible pcs to the U.S. While Seiko Epson had not even been exporting the types of semiconductors in question, it was one of the companies hurt worst by the sanctions. Despite shifting production of the pcs to South Korea and Oregon, the company still suffered substantial losses. Overall, sales of computer products fell slightly to ¥173.3 billion ($1.2 billion).

Also under pressure was Seiko's tremendously successful watch business. Cheap competition from lower-cost Far East producers, particularly in Hong Kong, added to the high yen's damage to overseas revenues.

Printers also suffered from having too much revenue in cheap dollars and too many costs in yen. Floppy disk drives are doing far worse than expected, even losing in-house sales to competitors, leaving a great deal of highly automated manufacturing capacity underutilized.

Like most of its Japanese competitors, Seiko Epson is moving much production overseas. In June 1987, production of its FX-1000 printer began at a new plant in England, followed in August by LX-800 printers. This gave Seiko plants in nine foreign countries.



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COMDISCO INC.

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(312) 698-3000

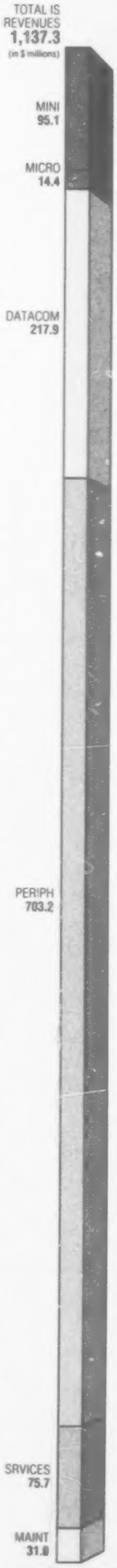
No computer company felt the savagery of last October's stock market dive more than Comdisco did. Comdisco Equities Inc., the stock arbitrage subsidiary that the company founded in 1984 lost just over $100 million—half its capital—on Black Monday. Comdisco management pulled the plug the next month. The arbitrage disaster left Comdisco with a $56 million loss for the quarter and wiped out a big chunk of its 1987 net income.

In its mainstream computer leasing and remarketing business, life was more kind. Revenues rose 20.5% to $1.2 billion, short of the stellar performance of the year before when revenues rose some 36%. During its fiscal year, which ended in September, Comdisco entered into leases with total payments of $1.4 billion during the initial term, compared with $1.7 billion the year before. A highly competitive market in the wake of the Tax Reform Act and the lukewarm reception accorded IBM's 3090 mainframes accounted for the slower growth. Many users decided to go for used 308Xs and Comdisco found itself remarketing many of the 308Xs in its lease base. That situation changed somewhat in the final quarter when IBM enhancements to the high-end 3090s stimulated action in that area and strengthened remarketing of the 3090 Model 200s.

Since 1984, Comdisco has been actively expanding its international operations and has begun to show strong results in Europe. Deliveries of the IBM 3090s in Europe created an active market there in 308Xs, which Comdisco was all too happy to handle. In three years, its European revenue has more than quadrupled to over $200 million. In Japan, where it has sales of about $25 million, Comdisco is involved in a joint venture with six Japanese leasing companies. Comdisco has begun to lease telecommunications equipment from several vendors, decreasing its reliance on the IBM mainframe marketplace.

Over the years, Comdisco has had its share of run-ins with the IRS. In 1987, the company paid $65.1 million to resolve audits for the years 1983 and 1984. The IRS is now auditing the company for 1985 and 1986. Comdisco maintains this will be a "non-event."

While it was being run over by Wall Street's bulls and bears, back home in the Windy City some unusually stormy weather gave Comdisco the chance to prove the mettle of its disaster recovery service. A record one-day rainfall in August caused three clients of that service to call for help. All three were accommodated, two at Comdisco's recovery facility in Chicago, and another in New Jersey.



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OKI ELECTRIC INDUSTRY CO. LTD.

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Minato-ku, Tokyo 105, Japan
(81-3) 222-6324

After losing ¥2.5 billion ($14.8 million) in 1986, Oki came strolling back into the black in 1987, with estimated net profits of ¥4.5 billion ($31.4 million). Revenues were up healthily, increasing 14.4% to ¥461.8 billion ($3.19 billion), while IS revenues rose to ¥169.9 billion ($1.14 billion). Although the financial turnaround made the company popular with securities analysts, basic structural problems remain for Oki.

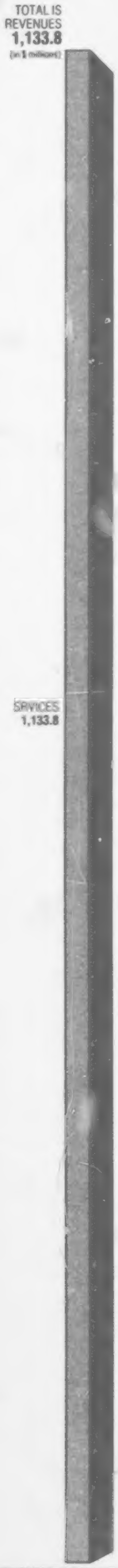
Oki entrenched itself in the manufacture of commodity items—such as printers and 256KB DRAMs—for which its competitive strengths were the Japanese structural advantages of a low yen and high production volume. These advantages have been evaporating. A lot of credit for Oki's financial improvement, in fact, goes to Uncle Sam: the semiconductor agreement has firmed up prices, stemming losses from 256KB DRAMs.

Oki took some steps to evade the high yen's effects. A Thailand factory is producing digital switches and a printer plant was constructed in Scotland in 1987, with a capacity of 17,000 dot matrix printers a month—just as laser printers are becoming the hottest peripheral market.

Some determined cost-cutting was responsible for at least part of the improvement in the profit picture. Domestic staffing actually decreased by almost 360, not counting flexible hiring levels among the part-time or temporary workers who support the so-called lifetime employment system.

Nippon Telegraph and Telephone procurement was another area in which Oki got lucky. With 60% of Oki's telecom revenues coming out of the former monopoly's ¥1.7 trillion ($11.8 billion) 1987 purse—a figure that was holding steady—telecom revenues were healthy. Facsimiles did well, with sales increasing more than 50%. The domestic market expanded as small businesses began to buy midrange models, while large businesses were upgrading to models with sophisticated time- and labor-saving features. Nonetheless, domestic fax revenues remained essentially flat because intense competition drove prices down across the board. On the other hand, shipment volume overseas, especially to the U.S., rose so much that even revenues earned in dollars grew on the yen balance sheet.

Despite the new printer plant in Scotland, and one in Atlanta, which also produces cellular phones and ICs, the printer market may give Oki some future problems. In addition to the costly yen, IBM has gone from being a customer to a competitor, constructing its own highly efficient factory stateside.



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COMPUTER SCIENCES CORP.

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Bogged down by litigation in the early 1980s, Computer Sciences Corp. (CSC) couldn't seem to pick up momentum: revenues were flat and earnings hovered at the $20 million level. The last few years, however, have been marked by shrewd acquisitions, hefty contract wins, and a new focus on systems integration. For the second year in a row, income has jumped more than a third, hitting $40.5 million in 1987, up from $30.3 million in 1986. Revenues have grown more slowly. CSC took in $1.13 billion last year, up 16% over 1986's $977.7 million.

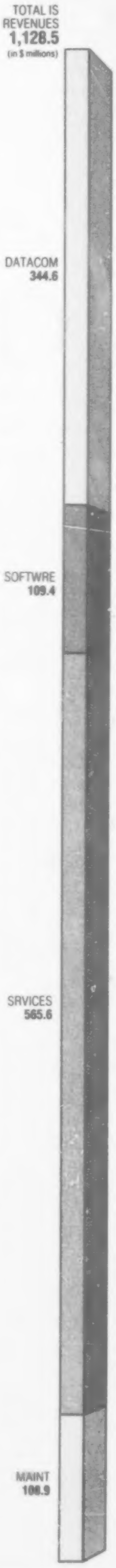
The National Aeronautics and Space Administration began CSC's year by awarding it a contract worth $1 billion over 10 years, by the company's estimate. The banner year went on to include a $278 million contract with the Air Force Flight Test Center and a General Services Administration contract for debt collection.

The recently acquired Computer Partners Inc. nearly doubled the revenues of CSC's Professional Services Organization, which aims at commercial systems development and integration. Another major grouping at the company is the Industry Services Group, which targets the health care, insurance, consumer finance, manufacturing, and tax preparation industries. It also benefited from acquisitions, but, citing lower revenue from Medicaid operations, reported a 7% drop in health and insurance systems. CSC Europe, a supplier of professional services overseas, also posted advances, as did CSC's Infonet value-added service.

The Systems Group, which focuses on government agencies and military services, is CSC's biggest money-maker. Its seven divisions pulled in 13% more revenue than they did the previous year.

Speaking at ADAPSO's management conference last March, CSC's chairman and president William Hoover forecast "20% to 30% annual growth in the systems integration market, resulting in worldwide revenues of more than $15 billion by 1992." With an eye toward grabbing a bundle of those bucks, CSC has named the former president of its Systems Group, Walter Culver, to the new post of vice president of systems integration.

Culver's mandate is to take CSC's systems integration expertise—gained in the federal sector—and sell it in the private sector. Culver singles out Europe as the coming boom market. CSC is in a good position, Culver continues, because of Infonet's strengths in "end-to-end network management" and international transmission.



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NIPPON TELEGRAPH AND TELEPHONE CORP.

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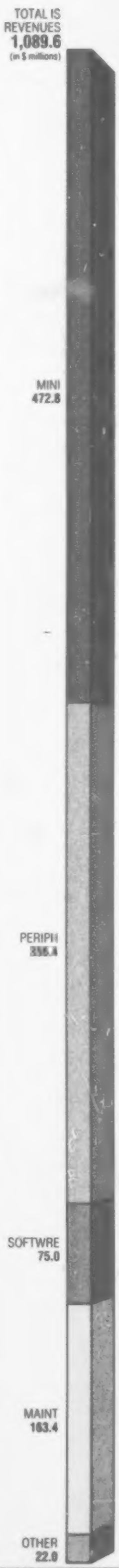
Nippon Telegraph and Telephone's biggest impact on the IS market in Japan is as a procurer of telecommunications equipment. With a budget of around ¥1.7 trillion ($11.8 billion)—which is about 10% the size of the Japanese government's—NTT's spending decisions measurably affect revenues of virtually every major electronics manufacturer. Most affected are the traditional "NTT family" members, including Fujitsu, Hitachi, NEC, and Oki.

Traditionally, NTT has served as a path through which government cash could benefit the private sector. (Although the giant corporation is now officially privatized, the government still owns 75% of its stock, worth about ¥37.4 trillion, or $258.6 billion.) The fruits of NTT's huge R&D budget—¥149.3 billion ($1.03 billion) in 1987—are transferred to its main suppliers, since NTT does no manufacturing itself. For example, NTT labs have been in the forefront of VLSI research. In February 1987, they were among the first to announce a prototype 16Mb DRAM, and company spokesmen admitted that the technology would be supplied to semiconductor manufacturers. Optoelectronics and intelligent processing are other subjects under research.

Another of NTT's functions is to attract good press for the government. The company has taken a number of highly publicized steps to increase procurement of foreign equipment, including holding procurement seminars in the U.S. and Europe, and setting up offices in California, New York, London, and Geneva to accept applications in English. The results have not been spectacular: less than ¥40 billion ($270 million), or just over 2% of total procurement, was from foreign companies in 1987, little more than the year before.

In May 1987, NTT's second Cray supercomputer, an X-MP/216, purchased in May 1986 amid a flourish of publicity, was quietly resold to a private company, Recruit, for use in its commercial timesharing service.

NTT's data processing and communications services account for only 3% of revenues, a mere ¥163.2 billion ($1.12 billion). They include networks that connect large-scale users such as government offices, financial institutions, and businesses. Another service, called ANSER, sends computer-generated messages or responses to phones, facsimiles, or modem-equipped pcs and is widely used by financial institutions and retailers. An on-line credit authorization network called CAFIS is used by credit companies and retailers, and an on-line banking system links the 13 major city banks with their corporate clients.



43

TANDEM COMPUTERS INC.

19333 Vallco Pkwy.
Cupertino, CA 95014
(408) 725-6000

Although tough competitors breathe down its neck in the growing on-line transaction processing market, Tandem Computers Inc. seems to remain a few crucial steps ahead with new products, strategic acquisitions, and joint ventures. In 1987, Tandem enjoyed the first billion-dollar revenue year in its 13-year history, when its sales hit $1.09 billion, a 28.9% increase. The company's profits soared 29% to $102 million.

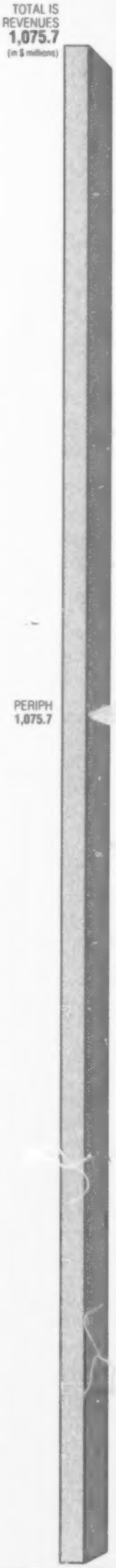
Tandem introduced 10 major software and hardware products in 1987, broadening its line of fault tolerant, NonStop computer systems. Among them was the CLX system—a CMOS design—which brings OLTP networks to branch offices and departments at performance rates of between two transactions per second and 12tps.

During 1987, Tandem opened its systems to the Unix world with the LXN multiuser microcomputer, for which it announced a series of upgrades early in 1988. It introduced an optical disk product, the model 5200, which has a storage capacity of 84GB. It also announced a family of seven MS/DOS and OS/2 workstations as peripherals to its transaction processing computers. Its major software offering is an SQL distributed relational database management system called NonStop SQL.

The company entered the Pick operating systems arena through an agreement with Ultimate Corp. and entered IBM's SNA market through an agreement with Netlink Co., a supplier of SNA interfaces. In June 1988, Tandem expects to complete the acquisition (for $260 million) of LAN specialist Ungermann-Bass Inc. in neighboring Santa Clara. Tandem continued relationships with 280 outside software companies developing programs that run on its systems. It signed an agreement with Electronic Data Systems, MSA Advanced Manufacturing Inc., and Boeing Computer Services to provide manufacturing software for the Tandem Integrated Manufacturing Environment (TIME).

Tandem's overseas sales grew 47% in 1987 and accounted for 43% of the company's revenue. Its U.S. sales grew 27% last year.

A highlight of 1987 for Tandem was the listing of its stock on the New York Stock Exchange. It also made its first major increase in staff in three years, hiring some 1,200 people, bringing its total employment to just over 7,000. R&D spending rose to $120.8 million last year from $92.7 million in 1986. By emphasizing innovation, Tandem is seeking to ward off such big OLTP competitors as IBM, Digital Equipment Corp., Data General, NCR, Hewlett-Packard, and Unisys.



44

SEAGATE TECHNOLOGY

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Scotts Valley, CA 95066
(408) 438-6550

Seagate Technology celebrated its first billion-dollar year in 1987. Profits of $115.3 million set a record, soaring nearly 30% over the previous year's $90.4 million, as sales for this maker of small rigid disk drives for personal computers hit the $1.08 billion mark.

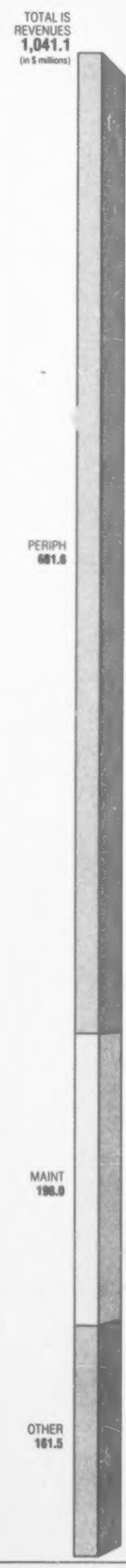
Although sales remained high in the second half of 1987, earnings for the period dropped off 39% to [illegible] million from the $62.1 million it chalked up the year before. Alan Shugart, chairman and ceo, said that this reflected the costs of introducing new products and expanding plant capacity. All of Seagate's production is now outside the U.S., which the company feels is a contributing factor to its very high profit margins.

Toward the end of 1986, Seagate introduced 13 new products, and in March 1987, it introduced six models of a 3½-inch disk drive family. Seagate expects 3½-inch disk drive shipments to account for nearly half of all its [illegible]ts by the end of 1988. IBM isn't expected [illegible] dominate Seagate's revenues as it has in the past. In the last six months of 1987, IBM accounted for only 24% of Seagate revenues, down from 30% a year ago.

Seagate has added 32,000 square feet to the Signapore facilities where its 3½-inch disk drives are made, and it expanded facilities in Thailand beyond subassemblies and components; the plant now assembles and tests completed disk drives. Seagate set up European headquarters in Versailles, France, and acquired Integrated Power Semiconductors Ltd. of Scotland for $7.7 million in cash. IPS, which makes integrated circuits, has been a longtime Seagate supplier. For $4 million, Seagate acquired another supplier, Aeon, a Brea, Calif.-based producer of substrates used by Seagate to make thin film magnetic recording media.

Seagate last year spent $40.9 million in R&D, more than double what it spent the year before. It has conducted its R&D at company headquarters in Scotts Valley, but last year it added a 10,000-square-foot R&D facility in Boulder, Colo., to be headed by Kenneth Johnson, director of electrical development. Some R&D also will take place in Singapore.

"Short product life cycles are normal in this business," says president David T. Mitchell, "so we must continue to develop and introduce new products as our customers require them." Seagate invested $14.6 million in 1987 in research and materials to reduce manufacturing expenses, lower material costs, and achieve better yields and higher unit production. It financed the stepped-up R&D and acquisitions in part by issuing $250 million in convertible subordinated debentures.



45

MEMOREX INTERNATIONAL

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(31-20) 97 4331

Following its management buy-out from Unisys in late 1986, Memorex International survived as an independent for only a year before its identity changed again. In January 1988, it merged with the U.S. Telex organization. The new company, Memorex Telex NV, is now headquartered in Amsterdam.

During its year of independence, Memorex International grossed IS revenues of G2.1 billion ($1 billion) from its line of IBM-compatible peripherals. Corporate profits for 1987 hit G95.2 million ($47 million).

Memorex regards itself as the world's leading independent supplier of IBM-compatible peripherals. Operating from 250 offices in 25 countries, the company has built up an installed base of 400,000 devices and a customer base of 40,000 companies.

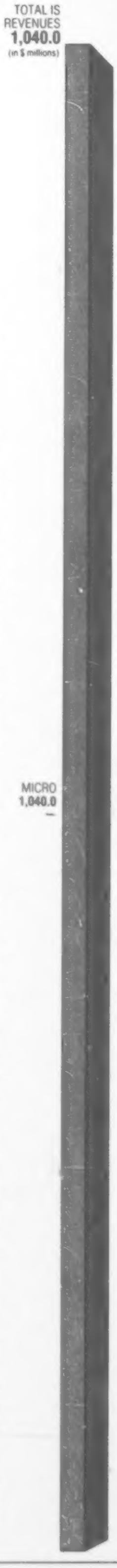
During the year, the company restructured to reflect its independent status. Management functions were decentralized to create more autonomous local subsidiaries with control over marketing strategies. A similar philosophy was adopted for the four main product areas: large storage systems, System 3X products, 3270 products, and personal workstations. Specialist sales forces were set up for each product.

Two of these product areas were new to Memorex last year. The company entered the System 3X marketplace, selling compatible peripherals and cpu upgrades. By the year's end, the business grew to $80 million in sales from virtually nothing. Memorex also brought out a range of personal computers and terminals known as Memorex personal workstations. These machines are made by French, Japanese, and Taiwanese companies and are sold under the Memorex name.

Altogether, the company introduced 33 new products last year, including the 6880 solid-state direct access storage device, the 4390 and 4780 nonimpact printers for large systems, and the IBM 3480-compatible 5480 tape drive. "We were the first pcm company to deliver a 3480 compatible, even though we were the last to announce it," points out Giorgio Ronchi, Memorex's chairman and ceo.

The peripherals giant entered two new market areas in 1987: leasing and third-party maintenance. Memorex acquired Paris-based Continental Leasing, which specializes in processors from IBM and other vendors, as well as Memorex peripherals.

Meanwhile, the third-party maintenance division just got started late in 1987, but the company is filled with hope that it will grow substantially this year.



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ZENITH ELECTRONICS CORP.

1000 Milwaukee Ave.
Glenview, IL 60025
(312) 391-7000

For Zenith Electronics Corp.'s Data Systems division, 1987 might be considered a watershed year. The company made several moves to establish itself as an aggressive contender in the increasingly crowded IBM-compatible market.

Sales of Zenith pcs soared 90% to just over $1 billion. Zenith capped the year by becoming the first oem to ship a version of Microsoft Corp.'s OS/2 operating system, geared to run on the company's ZDS Z-200 and Z-300 personal computers. Zenith worked closely with Microsoft in developing the OS/2 adaption kit, allowing the company to beat other manufacturers to market.

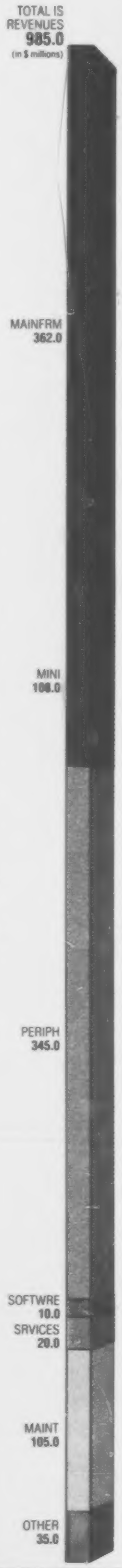
In September, Zenith began shipping a monitor implementing its new flat-screen technology, virtually free from glare and reflection. Zenith spent several years and $50 million in research and development costs on the new monitor.

Clever from a marketing standpoint, if less innovative technologically, was the "eaZy pc" Zenith introduced. It's a low-priced system designed for novice users, aimed at simplicity to the point that instructions on the plastic-wrap covering the monitor screen call for the user to "Remove this piece of plastic." Some "eaZy pc" successes surprised even Zenith officials: American Airlines purchased several of the systems and offered the pcs to their pilots and flight attendants for scheduling purposes.

Zenith nailed another large government contract in 1987, this time for portable laptop pcs. The contract was the largest ever awarded by the U.S. government for personal computers, worth about $104 million, for an estimated 90,000 Z-180 laptops to be used by the U.S. Navy, Air Force, Army, and Defense Logistics Agency. Although some analysts question whether Zenith scores much profit with its government business, company officials say that government contracts force Zenith to be an efficient low-cost manufacturer.

Top management changed at Zenith last year. John P. Frank moved into the presidential slot vacated by Robert P. Dilworth, who left to join a privately held company. Frank had been senior vice president of sales and marketing for the company, guiding its sales strategy for the past several years.

While still marketing through its chain of Heath/Zenith Computers & Electronics centers, Zenith signed several agreements with retail chains last year. It initialed pacts with Businessland Inc., San Jose, and Inacomp Computer Centers Inc., Troy, Mich., to distribute Zenith portable pcs.



47

NATIONAL SEMICONDUCTOR CORP.

2900 Semiconductor Dr.
Santa Clara, CA 95052-8090
(408) 721-5000

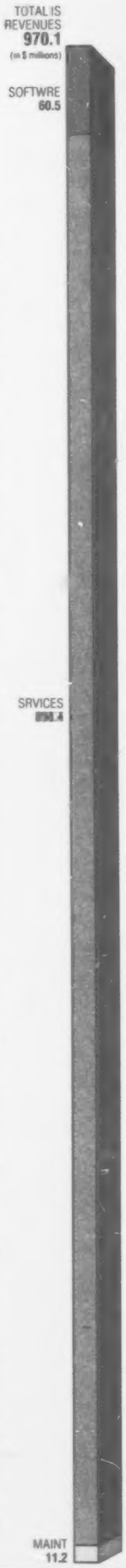
A broad semiconductor market recovery and continued strong demand for its IBM-compatible mainframes combined to give National Semiconductor a profit of $6.6 million in 1987, its first in over two years. The company lost $53.6 million in 1986.

National Semi was helped by a trend toward consolidation among U.S. semiconductor vendors. Its acquisition of longtime rival Fairchild Semiconductor Corp. helped boost 1987 revenues to just over $2 billion, up from $1.68 billion in 1986. Almost half its revenues, $985 million, came from IS businesses: mainframe systems and storage products, service and support, Datachecker point-of-sale retail systems, and memory boards for Digital Equipment Corp. and Macintosh systems. Overall, National Semi's IS revenue was up 35.9% over 1986.

Most of the IS growth came from the sale of large processors, as National Semi's pcm subsidiary, National Advanced Systems, continued to enjoy strong demand for its AS/XL mainframes, manufactured by partner Hitachi Ltd. and distributed by NAS in North America and Europe. NAS has shipped about 120 AS/XLs, which compete against IBM's 3090 system and the 5890 mainframe from Amdahl Corp. New AS/XL customers in 1987 included Chevron Corp., Bank of America, the Commonwealth of Massachusetts, Clemson University, and Aerospatiale France.

National Semi's $122 million acquisition of Fairchild in September elevated the company into third place among U.S. semiconductor makers, ahead of Intel Corp. and behind Motorola and Texas Instruments. The deal also increased its worldwide employee count to about 38,000, although it later announced plans to lay off about 900 workers.

On the IS side, 1987 saw NAS significantly increase its shipment of 3380-class single- and double-density mass storage devices, becoming the leading pcm DASD vendor. NAS also introduced an entry-level mainframe to compete against the low end of the IBM 3090 product line. Called the AS/VL, it is manufactured by Hitachi. NAS also began focusing its attention on engineering and scientific applications, pouring R&D money into new software, and signing joint development agreements with Sun Microsystems Inc. and Interlink Computer Sciences Corp. NAS and Sun are migrating a version of Sun's Unix-based operating system to the NAS mainframes. Interlink has developed with NAS a high-performance connection from NAS mainframes to DEC minicomputers. Altogether in 1987, NAS increased its IS R&D spending to $30 million.



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SOCIÉTÉ GÉNÉRALE

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For the first time, an international bank has entered the DATAMATION 100. The two major IS companies owned by Société Générale, one of France's largest banks, generated revenues of FF5.8 billion ($970 million) in 1987.

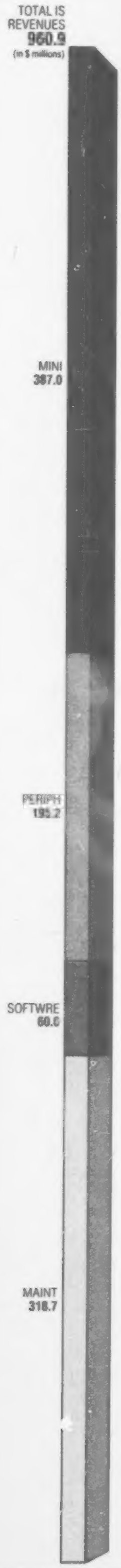
The largest of the two is Europe Computer Systemes (ECS), a computer leasing and services outfit in which Société Générale has an 80% stake. ECS reported FF5.1 billion ($848.9 million) in 1987 revenues, 29.7% over 1986. Its other subsidiary is SG2, a software and services firm that is wholly owned by Société Générale. SG2 announced revenues of FF728 million ($121 million) last year.

(The bank also has a 34.4% interest in another of France's biggest service companies, CCMC. This company's 1987 revenues of FF950 million [$158 million] showed little growth, reflecting the fact that over two thirds of its revenues still comes from timesharing and service bureau activities.)

A full 98.7% of ECS's 1987 revenues derived from computer leasing. ECS deals in IBM mainframes and minis, as well as in Bull, Compaq, and Toshiba equipment in the micro sector. ECS's five foreign subsidiaries in Italy, the U.K., Japan, West Germany, and Belgium, all established from 1986 to 1987, contributed revenues of some FF1.1 billion ($183 million) in 1987—mostly from Italy and the U.K.

Three years ago, ECS branched out to set up subsidiaries specializing in maintenance (ECS Maintenance), training (ECS Bureautique), and the sale of micros (ECS Diffusion). In 1987, it created three new ventures: ECS Technologies provides support for minis and micros, developing CAD/CAM applications in particular; the ECSIS subsidiary focuses on systems integration; and the Proland startup, a joint venture with CCMC, was created through the merger of three small firms acquired for that purpose—Nipsi, Promatec, and SPS International. Proland develops software for IBM minis.

Meanwhile, SG2 has had a rough time in recent years, undergoing a sharp contraction in staff and a recentralization of activities. Revenues peaked in 1984 at FF1.3 billion ($152 million), while losses reached FF69 million ($7.7 million) in 1985. The company made a small operating profit in 1987, but the net result was another loss due to restructuring costs and financial charges. SG2 now concentrates on a few specific sectors, notably banking and finance, consultancy/systems engineering, and packaged software. Its banking and finance subsidiary, SG2 Moyens de Paiement, accounted for about half of the company's revenues in 1987.



49

PRIME COMPUTER INC.

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Natick, MA 01760
(617) 655-8000

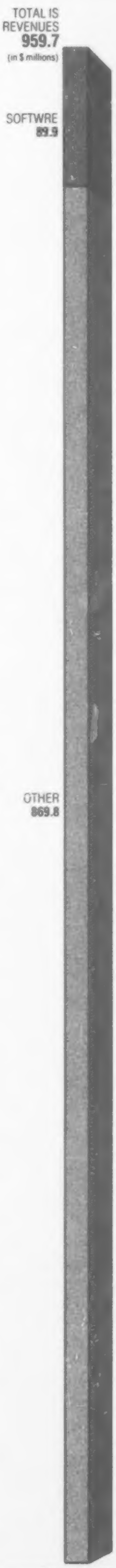
Prime's dogged pursuit of critical mass—its aim is $2 billion in annual sales by 1990—climaxed in the last week of 1987 when the company launched an unfriendly, but ultimately successful, takeover of New England neighbor, Computervision. When the deal was concluded in February 1988, Prime was some $450 million poorer, but also, overnight, the second-biggest player in the CAD/CAM business after IBM. The buy, which vaulted Prime to $1.5 billion-plus size, was an admission that the mini maker could not reach its revenue goal solely by internally generated growth. Still, Prime's 1987 revenues were up 12% to $960.9 million, and profits grew a healthy 38% to $64.8 million.

Prime is now predominantly a manufacturing systems company: in 1987, some 19% of Prime's total sales came from its automated design and manufacturing business. Insiders now say that figure will soar to more than 50% following the Computervision acquisition. Although Prime will attempt to maintain a generalist posture, its relative lack of scale will force it to seek out vertical niches. Prime's strategy is to build systems in which its 50 Series mini, though the linchpin, is nevertheless just one ingredient in the mix.

Prime's outside sourcing of components, highlighted by oem deals with Sun Microsystems, MIPS Computer Systems, Silicon Graphics, Cydrome, and now—through Computervision—Digital Equipment Corp., has led many to wonder whether Prime is really a systems integrator rather than a manufacturer. Over 70% of Prime's cost to build its equipment goes for oemed components.

Last year turned out to be the end of the line for the 16-year-old mini maker as a vendor of purely proprietary technology: Prime's EXL supermicro offered not only the Intel 386, but Unix System V and MS/DOS as well—all of it coupled with 58 asynchronous lines to link it to mainframes, minis, and pcs. The company also introduced new CAD/CAM workstations featuring Unix.

The year was Prime's busiest ever for product introductions, led by the high end of its flagship 50 Series. Now shipping in volume are an 11.8MIPS 6350 and the dual-processor, 23.6MIPS 6550, both targeted primarily at Prime customers that have outgrown their systems. Like DEC, Data General, and the other mini makers, Prime must convince users that in a world of micros and reduced instruction set computers, there is still a place for the venerable minicomputer: a tough task when the growth in new minicomputer sites has now fallen to about 5% a year.



50

ATLANTIC COMPUTERS PLC

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Atlantic Computers is the sole survivor of a round of takeovers that saw its four main rivals in computer leasing absorbed into other groups. Two of Atlantic's competitors are now owned by Inspectorate International of Switzerland, while Atlantic finds itself the only independent computer leasing firm in the U.K. The company hit the takeover trail itself in 1987, snapping up three smaller firms.

Atlantic secured the CBF Group, Australia's largest leasing company, for $15 million. In the U.K., Atlantic merged with Compcap, which specializes in leasing peripherals, and which brought over $200 million in revenues to Atlantic last year. The deal gave Atlantic access to the Danish-designed IBM systems software owned by Compcap. Atlantic also bought Hamilton Rentals, a U.K. rental firm specializing in Digital Equipment Corp. equipment. In all, Atlantic spent just under $250 million on acquisitions in 1987. As a result, its revenues soared to £587.1 million ($959.7 million) from £320 million in 1986, while profits hit £32.8 million ($53.6 million).

Since leasing is the means of acquisition for nearly a third of all large systems now being installed in Europe, Atlantic's prospects seem bright. The company has over 800 systems in the field in the U.K., most of them IBM. Mindful of the need for good relations with Big Blue, Atlantic last year withdrew a lawsuit filed against IBM. The action had been brought by ICA, a Dutch company Atlantic bought in 1986. ICA accused IBM of giving anticompetitive special discounts to customers.

On a sad note, Atlantic's fast-moving chairman and chief executive, John Foulston, was killed while practicing for an auto race at Silverstone, England. Foulston owned three auto racing tracks in the U.K. He has been succeeded in the top job by John Tompkins, formerly the company's chief finance officer. Despite the loss of Foulston, who had in four years built Atlantic into the largest leasing firm in Europe, Atlantic's appetite for growth carries on undiminished.

Atlantic has targeted data communications as a key market, bringing out a new line of modems, multiplexors, and packet switching equipment. It also plans to expand into the private network market. This year, Atlantic's communications subsidiary concluded a $2.8 million deal with Seattle-based Wall Data Inc., which allows Atlantic Network Systems to distribute Wall Data's data communications products outside the U.S. and Canada. Wall Data gets to make Atlantic's Orator voice/data pc system in the U.S.

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NORTHERN TELECOM LTD.
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With its two main markets—PBXs and central office switches—more or less in the doldrums, Northern Telecom feverishly has tried to drum up sales through snazzy product enhancements and new overseas ventures. These are all strategies for the long term, however: the here and now is pretty tough going.

The company's revenues rose to $4.85 billion in 1987, an 11% climb—primarily a reflection of how poorly it did in 1986. That year, software glitches in its central office switches—which account for more than half of revenues—all but wiped out sales growth. In the early 1980s, the central office switch market boomed as the Bell operating companies overhauled their equipment. But with the BOCs in a retrenchment mode, those halcyon days show no sign of returning soon. To spur interest in its switches, NT introduced DMS SuperNode, an add-on that gives new features and functionality to existing switches and makes them compatible with equipment offered by other switch vendors.

Sales of NT's Meridian Digital PBXs and other computer products were essentially flat from 1986; DATAMATION estimates them at about $900 million. To boost sales and ward off the 8% to 9% price declines in the PBX market, NT added enhancements to its Meridian SL-1 PBX, ISDN capability among them. The company added Prime Series 50 computers to the list of systems that will work with the SL-1 and it hooked up with Digital Equipment Corp. to provide ISDN-like services using VAXs.

Sluggish PBX sales led NT to shave costs at its Santa Clara plant. This move contributed to the 15% increase in net 1987 income to $329 million, with gross margins just topping 40%.

The big international move for the company in 1987 was an $833 million acquisition of a 27% stake in England's STC plc. NT hopes the acquisition will open the doors of British Telecom and provide some breathing room outside tight Canadian and U.S. markets. NT established a subsidiary in France and a joint venture in China to manufacture the Meridian SL-1, and it combined overseas subsidiaries into one organization, Northern Telecom World Trade, headed by Desmond Hudson.

In 1986, the company sold its western U.S. sales and service outlets to Pacific Telesis. Deeming the strategy no longer prudent, NT reversed course in 1987 and formed a joint sales and service venture with PacTel.

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C. ITOH & CO. LTD.
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Minato-ku, Tokyo 107, Japan
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The huge trading firm C. Itoh makes less than 1% of its revenues from IS products. Being a trader rather than a manufacturer gives it great advantage when an escalating yen has most Japanese electronics manufacturers struggling to shift production offshore and decrease export dependence.

Because C. Itoh does not have the kind of R&D staff found at the major manufacturers, it is restricted to selling established products rather than leading-edge technology. Dot matrix printers, mainly exported to the U.S. and Europe, are an example. They suffered the double whammy of the expensive yen and inroads by more exciting laser printers: revenues were flat and profits were down. However, a belated June jump into the laser printer market brought C. Itoh some healthy new sales.

Although a certain part of domestic sales are of commodity products, such as terminals manufactured to C. Itoh's specs, the firm also acts as distributor for top-notch foreign manufacturers that need a sales network in a market that is notoriously tough and expensive to get into on one's own. Subsidiary C. Itoh Techno-Science is selling Sun workstations, which had outstanding sales in 1987. Other high-tech foreign products showed mixed results. Sales of Stratus fault tolerant computers are described as "just starting up." Texas Instruments' Explorer AI workstation is "growing" in sales, while sales of Culler Scientific Systems minisupers are "slow." Overall, sales of computer products fell 12% to ¥119.9 billion ($829.2 million).

The company sees potential for further growth in several IS areas. Engineering workstations is one. Another is a category that is coming to be known in Japan as "office workstations." These are essentially high-powered micros with software that enables them to handle fairly substantial business tasks and to tie into mainframe-based networks.

53

GENERAL ELECTRIC CO.
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Fairfield, CT 06431
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GE again set revenue and earnings records. Revenue rose 10.3% to $40.5 billion and net income increased 17% to $2.9 billion. The gain didn't come without pain: about 57,000 heads rolled throughout the company, lopping 15.9% off a payroll that now stands at 302,000.

Although financial performances for individual GE business segments are top secret, DATAMATION estimates that IS revenues remained flat at $800 million. GE Information Services, the company's main player in the IS business, closed its books with $450 million in revenues, no more than the previous year.

Calma, which is the company's CAD piece, finished the year with the same $180 million as it did in 1986 and experienced its fifth consecutive year of declining market share. The remainder of GE's IS revenues came from GE and RCA's third-party services combination, also flat at $170 million.

GE Information Services president Anthony Craig continued to stress the international advantages of what GE says is the world's largest commercially available teleprocessing network. The strategy was evident in electronic data interchange (EDI) for standards-based business documents, as well as in its core banking and financial services business.

Barry Clarke, vice president and manager of business planning for GE Information Services, says, "We got into the information network business via timesharing. But we lost our timesharing base in the U.S., and had to replace it with new services. We did the same in Europe and Asia, although we hadn't lost the timesharing base. We put a lot of investment in services such as EDI."

The company was selected by the European Council of Chemical Manufacturers' Federations as the single clearinghouse for EDI services in the EDI trial for the European chemical industry.

While EDI is presently only 7% of GE's IS business, "We expect it to be one third of our business by 1992," Clarke says.

"I think we completed our transition last year," Clarke adds. "We understand where we're going. We're just not there yet."

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TELEX CORP.
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Tulsa, OK 74135
(918) 627-2333

IBM's aggressive pricing tactics and an unfriendly takeover bid from raider Asher Edelman drove Telex into the friendly arms of Memorex International N.V., a $900 million merger that creates the largest IBM-compatible peripherals company in the business.

For Telex, it was a tumultuous end to a difficult 12 months. Early in the year, Telex stock was at an all-time high, a reflection of its enormous success as the leading supplier of IBM-compatible 3270 terminals. However, IBM's rock-bottom pricing forced Telex to respond in kind while broadening its product line to include voice data terminals, System 3X peripherals, new airline reservations terminals, and pcs. Shipments of new products fell short of expections, and development costs were higher than hoped. In the second quarter, Telex officials slashed their earnings estimates, the stock price slid, and Edelman commenced his raid. Telex was able to fend off Edelman until its rescue by Memorex.

The merger unites two companies that pioneered the IBM-compatible peripherals market. Part of Burroughs for half a decade, Memorex was taken private in December 1986 by a group of investors and London-based executives of the firm. Headquartered in Amsterdam, it does 70% of its business—primarily IBM-compatible storage products—outside the U.S., while Telex's sales are virtually all domestic. For the year, sales of all of Telex's computer products rose 8.3% to $788.9 million, while net income dropped 22% to $56.6 million. Revenues from terminals and controllers grew only 7.5% while sales of Telex's new PBX products fell slightly. The bright spot was sales of workstations, which more than doubled to just under $50 million.

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COMMODORE INTERNATIONAL LTD.
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West Chester, PA 19380
(215) 431-9100

Commodore International Ltd. made a comeback to profitability in mid-1986 and kept it going through all four quarters of 1987, posting net income of $37.1 million on revenues that fell slightly to $785 million.

But Commodore's troubles were far from over. Management shake-ups continued in 1987, and the company struggled through a transition in its product offerings. Thomas J. Rattigan, named ceo in April 1986, was ousted and chairman Irving Gould, who has been with Commodore since the 1960s, was elected ceo in April 1987.

Commodore's Amiga family of high-priced, high-performance pcs, introduced in late 1985, has not soared. Meanwhile, sales of the company's old C line of low-priced home computers, the C64 and C128, have been declining.

Commodore must replace lost revenues with Amiga sales.

The company has taken a number of steps to boost Amiga's image. It repositioned the family and introduced two new models in 1987. The Amiga 500 and 2000 both have the proprietary operating system that has been a factor in the low market acceptance of earlier Amiga products: there was little software available for the machines. But Commodore introduced a card for the 2000 that lets it run MS/DOS programs.

Software vendors are now developing programs for the Amiga, a move the company hopes will raise sales. Other strategies involve selling Amigas as solutions in niche markets: the model 500 in government and education, and the model 2000 for business and office automation.

Commodore's family of MS/DOS clones have enjoyed good success overseas, where they were first introduced (Europe accounted for 75% of Commodore's 1987 business), and when the PC-10, -20, and -40 were introduced in the U.S. last year, the company could not meet heavy demand for the products.

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Mountain View, CA 94043
(415) 960-1300

Every DATAMATION 100 needs its meteoric rising star. This year, Sun Microsystems fills the bill, achieving more internal growth than any other company on the list. The six-and-a-half-year-old workstation vendor boosted its sales by 122% to $755.9 million; its earnings nearly doubled to $48 million.

Sun boomed by broadening the market for its line of technical workstation products and by riding the growing user demand for standards. Sun drove the starting price of its high-performance workstation products below $5,000, putting them in competition with personal computers from IBM and Apple. The market for Sun's workstations grew from technical and engineering users to include commercial users involved in applications such as securities trading automation and financial analysis. By the end of the year, Sun claimed an installed base of over 50,000 workstations and board-level products.

Sun made points with users—though not necessarily with other vendors—by pushing for operating system and communications standards. Sun's Network File System was widely adopted as a standard among vendors of Unix-based hardware, and Sun began to push aggressively for a single, standard version of the Unix operating system that could be used on systems stretching from workstations to mainframes.

First, Sun signed an agreement with Microsoft to merge Microsoft's Xenix with its SunOS Unix implementation. Then, Sun agreed with AT&T to merge SunOS and Unix System V. Finally, Sun agreed to migrate versions of SunOS to mainframes from Amdahl Corp. and National Advanced Systems. Some Unix vendors accused Sun of bypassing ongoing standards efforts, such as the IEEE's Posix committee. However, other vendors, including Unisys and Xerox, signed on to remarket the Sun-AT&T Unix.

Tied to Sun's Unix efforts was its introduction of a new RISC-based microprocessor—called SPARC—around which Sun is building a new, high-performance workstation family. Sun also is licensing SPARC to other vendors, including Unisys and AT&T, which will use the chip in workstations of their own.

Sun's rapid growth led it to look

Illustration by Didier Cremieux

for new sources of capital: for $300 million, AT&T acquired a 20% stake in Sun and a seat on the company's board of directors. Sun did some acquiring of its own in 1987, most significantly of Centram Systems, a Berkeley, Calif.-based LAN vendor.

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STORAGE TECHNOLOGY CORP.
2270 S. 88th St.
Louisville, CO 80028
(303) 673-5151

Intoxicated by staggering growth in the 1970s, Storage Technology Corp. staggered from monumental losses in the 1980s. Now, StorageTek has emerged from bankruptcy with a record of 10 consecutive profitable quarters.

Ceo Ryal Poppa had the pleasure of announcing a 7.8% increase in revenues for 1987, to $750 million, over 1986's $696 million. A 25% increase in sales, mostly owed to the boost to international revenues from the weakened dollar, was offset by declining rental and service revenues. Profits were down 28.2%, but were a welcome contrast to the embarrassing losses of the recent past.

Naysayers point to declining engineering strength and lagging credibility in the user community as qualifying the company's success. Yet StorageTek's emergence from Chapter 11 in July may be reason enough for optimism. All bankruptcy-related lawsuits have been resolved. StorageTek distributed $187 million in cash, $285 million in notes, and 193 million shares of stock in the settlement of its debts.

In keeping with the post-bankruptcy emphasis on bread-and-butter products, StorageTek announced a slew of enhancements in 1987. In the DASD area, which accounts for 45% of revenues (up from 40% in 1986 and 34% in 1985), the company reports that sales of its new, reduced footprint disk drive, the 8380R, are good; that sales of its new 8380P with improved access time are disappointing; and that it's too soon to tell for the 8380-3X, which offers triple capacity. The 4380, a 3Gb enhancement of the venerable 4305 solid-state disk subsystem, began shipping in the last quarter of the year. Though StorageTek began selling the 18-track 4480 tape drive to users ready to graduate from the old 9-track 4670, it could not stop the slide in the tape products' contribution to revenues—35% in 1987, down from 41% the year before and 52% in 1985.

The biggest announcement remains the biggest question mark for StorageTek: the 4400 Automated Cartridge System (ACS), a $250,000 tape library offering 19.2 terabytes of memory and an access time of 11 seconds. The shipment of 45 modules so far may be the beginning of a trend that Poppa projects will net ACS almost $2 billion in sales over the next five years.

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ARTHUR ANDERSEN & CO.
69 W. Washington St.
Chicago, IL 60602
(312) 580-0069

The Big Eight accounting firm Arthur Andersen & Co. saw revenues leap 24% in 1987 to $2.48 billion from $2.01 billion in 1986. This impressive growth was outstripped only by its gain in IS consulting and software revenues, which soared to $749 million from 1986's $546 million, a 37% leap. IS business now accounts for almost a third of the company's annual take, and it may kick in close to a billion dollars in 1988.

The phenomenon of IS work being done by an accounting firm is not a new one—Arthur Andersen's been pulling off the trick since 1952, and it is not unique. The Big Eight's IS revenues are closing in on $2 billion annually. Andersen's Management Information Consulting Div. (MICD) now employs over 12,000 people, most of whom are doing IS consulting. In addition to IS work such as systems integration and design, MICD also does strategic planning, studies, and training. Overall MICD revenues were up by almost half in 1987, to $936.3 million from $635.9 million. According to Mel Bergstein, managing director of MICD, Andersen applies 6.6% of that money, or about $60 million, to R&D, and a similar amount to training. Bergstein says that the R&D funds go into CASE, AI, CIM, and communications.

Early this year, Andersen introduced Foundation, a DB2 CASE product that, according to the company, supports the entire systems development life cycle. Foundation's three major components are Method/1, a pc-based life cycle methodology; Design/1, a set of tools for automating systems design; and Install/1, a mainframe environment for applications generation. Foundation and Andersen's other software products, which brought in $43 million in 1987, are now being sold by a 24-person sales staff. The thinking behind the new emphasis is simple, says Bergstein: "Clients call the product suppliers first when they want to buy services."

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TEXAS INSTRUMENTS INC.
P.O. Box 655474
Dallas, TX 75265
(214) 995-2011

Last year, TI's net sales grew 12% to almost $5.6 billion. Net income soared to $309 million. But over 80% of this revenue—and virtually all the profit—stemmed from semiconductor and government-related business (including defense), all cyclical business.

TI's third biggest operation, Digital Products, is an exception to this nerve-racking variability. Its results have been remarkably consistent: consistently mediocre. The group lost $28 million on declining sales of $891 million; DATAMATION estimates that $740 million of this represents sales of computer products. A succession of lackluster "me too" minicomputers has been churned out, and they are increasingly of an open systems flavor, such as the networked System 1000 Unix-based models. Digital Products finally may have hit on a winner though: truly effective computer aided software development technology.

After a 20-year buildup, TI is believed to have one of the most sophisticated global computer networks in the world—certainly one of the top SNA networks. Much of its R&D spending has gone into the creation of AI and expert systems software to fine-tune the network, refine the manufacturing process, and improve (electronic) relations with customers.

The Explorer and MicroExplorer Lisp chips—which, as a summer 1987 announcement revealed, are now available on Apple's Macintosh computer—are a product of this process, as is TI's Personal Consultant family of expert systems interfaces. Of more immediate interest to MIS executives at IBM shops is TI's new IEF (Information Engineering Facility) family of tools, which brings CAD/CAM-like techniques to software development.

Insiders reveal that TI has been plowing more than a million dollars a month into the ongoing development of these tools, adding that this spending was a major factor in the Digital Product Group's lack of profitability in 1987. The software runs on TI and IBM PCs (including PS/2) and IBM mainframes, and already has attracted a devoted following at MIS shops here and overseas. By April 1988, TI disclosed that it had signed up more than 90 major corporations, including 25 of the 100 largest U.S. MIS organizations, for IEF, and many are claiming a fourfold productivity increase.

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MOTOROLA INC.
Motorola Center
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Schaumburg, IL 60196
(312) 397-5000

In a good year for the semiconductor business, Motorola returned to a segment of the market it had abandoned to the Japanese only three years ago. Demand for DRAMs was intense and Motorola resumed production at its plants in Arizona, Texas, and Scotland.

Only two years ago, Motorola's semiconductor revenues had plunged 23%. Having risen a modest 9% in 1986, they soared in 1987, up 17% to $2.2 billion. Operating earnings nearly doubled to $171 million from $81 million.

While semiconductor sales were spectacular and the communications products group reported a profit increase of 7% to $259 million, computer business revenues were off 14%, with an operating loss for the fifth consecutive year. Total corporate revenues were $6.7 billion, up from $5.9 billion, and profits reached $308 million, up from $194 million.

The computer operation, purchased by Motorola five years ago for $250 million, has undergone an extensive reorganization under Edward F. Staiano, a senior manager who arrived on the scene two years ago. There are signs he could turn things around: Motorola Computer Systems reported a 38% increase in new orders in 1987 and ended the year with a backlog that is 70% higher than a year earlier. The operation introduced seven models of its System 8000 supermicrocomputers. Included were products based on the Motorola 68030 32-bit microprocessor.

As part of a recently launched new enterprises operation, the company formed the Motorola Computer X group to design and produce real-time distributed computer systems aimed at the CIM market, combining a real-time Unix OS and Motorola's cX operating system on the same processor.

The company gained recognition as a major player in the Unix world when it agreed with Unix developer AT&T to open Unix systems to multiple users of Motorola microprocessors. The agreement was announced in February of this year, shortly after AT&T announced a controversial agreement with Sun Microsystems to develop a "unified" version of Unix. AT&T also has an agreement with Microsoft for a unified Unix for Intel 80386 chips.

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CRAY RESEARCH INC.
608 Second Ave. S.
Minneapolis, MN 55402
(612) 333-5889

Last year was a tumultuous one for the world's leading supercomputer maker. It began with the announcement of an entry-level, $2.5 million system, the X-MP Model 14se, the least expensive Cray machine ever introduced (a Cray supercomputer can cost anywhere between $5 million to $20 million). Aiming at the minisupercomputers nipping at its low end, Cray sold just two of the X-MP 14ses.

Front-page headlines resulted when Cray revealed that it was canceling a major project to develop a next generation supercomputer, known as the MP. Cray said the project had become too costly and too risky, its success depending on radical technology and the development of new components. The move prompted the resignation of Steve S. Chen, the brilliant supercomputer architect who designed Cray's best-selling X-MP computer. The company incurred $5 million in discontinuance costs.

The industry was jolted again by later news that Chen would jointly develop a new, 64-processor supercomputer with IBM. Meanwhile, Seymour Cray is busy working on the Cray-3—slated for mid-1988 shipment—and the Cray-4, a gallium arsenide, 64-processor, one-nanosecond supercomputer.

The Y-MP, the next generation computer in the X-MP family, was expected in 1987, but the machine didn't appear until early 1988. The $20 million, eight-processor machine is two-to-three times more powerful than the X-MP.

Cray had revenues of $687.3 million in 1987, a 15% increase that was dramatically less than 1986's 57% growth. Earnings were $147 million, up 18%.

The bad news? Average system value will continue to fall below $12 million, revenue growth is predicted at only 10%, and U.S. and Japanese competition will continue.

62

MANNESMANN AG
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4000 Düsseldorf 1, West Germany
(49-211) 8201

Currency market turbulence buffeted Mannesmann Kienzle in 1987, but concentration on vertical marketing strategies and a realistic recognition of the need to restructure helped the company weather the worst. While the dollar's drop drained IS profits, the company managed a 16% increase in IS revenues to DM1.23 billion ($686 million).

Changes centered on management and tactics—in part because scientists as well as businessmen have advanced to the firm's top ranks. Georg Fäber, who became managing director of Mannesmann's new Development Div. after the company picked up 65% of his firm, Peripherie Computers System GmbH last year, developed the Unix-based Cadmus CAD/CAM system for the Mannesmann product line.

Mannesmann declines to discuss sales targets, but, sticking to its goal of increased presence in the European market, maintains that it did much better than it had planned in 1987. It acquired Hallmark in the U.K., Mapresa in Madrid, and Bolliger in Liechtenstein. West German orders increased some 20%. Banking institutions and the public administration sector again headed its list of major customers. Orders for terminal computers and document processing systems climbed 30%.

Its printer business did well despite an unfavorable business climate and an unsteady dollar. Tally, the conglomerate's printer manufacturer, reported a 32% sales increase in the U.S., while growing only 8.5% worldwide. The printing operation expanded via the acquisition of Alfa System Partner GmbH.

The company's main IS strategy is now based on increased market sector specialization and so-called "Centers of Excellence." The centers, located in several West German cities, pinpoint specific target markets, especially manufacturing, banking, administration, distribution, and printing. In 1987, several hundred marketing and software experts working in these centers focused on industry-specific, problem-solving software. The company hopes vertical software will distinguish it from competitors such as Nixdorf—a wise move in the new, open systems world where hardware is becoming a commodity item.

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MARTIN MARIETTA CORP.
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Martin Marietta streamlined itself into four principal business groups in 1987 and showed a healthy 8.8% gain in revenues to $5.42 billion, as well as a 14% increase in profits, to $230.6 million.

The IS group, comprised of Data Systems and Information & Communications Systems, had a respectable year that looks almost spectacular compared with the recent past: not counting sales to other Martin Marietta units, revenues at the IS group rose 4% to $685.7 million. The real story was the operating profit, which reached $51.3 million, up from less than $2 million in each of the last two years.

A lot of the good news was delivered by the Data Systems division, which turned a profit for the first time in three years on revenues of $506 million, up 8.3% over 1986's $467.4 million. Among the deals that added up to what the company says was the highest profit in MMDS's 17-year history were contracts with the U.S. Navy, Army, and Air Force; the Immigration and Naturalization Service; the General Services Administration; the Treasury department; and the Department of Labor.

The division has had an uneasy transition to success. It shifted its focus to systems integration and saw its flagship RAMIS II product slip in the market. MMDS sold off RAMIS II along with its other packaged software in 1986, but retained its custom applications software and services operations. In early 1987, the group said good-bye to president Patrick Zilvitis, who had presided over two years of gloomy results. Taking the helm was Frederick Hudoff, formerly vp of the Air Traffic Control Div.

Early this year, Martin Marietta bagged a huge contract, a five-year, half-billion-dollar deal for the design, installation, and operation of the National Test Bed, an advanced computer simulation network and facility for the testing of defense systems planned for the Strategic Defense Initiative. It's the largest SDI contract ever awarded.

Last year was the first as a public company for Hoskyns Group plc, Data Systems' U.K. subsidiary, and it was a good one. Hoskyns enjoyed record sales and profits in 1987, up 18% and 46%, respectively. It also inked deals with Midland Bank and the London Post Office, among others, and itself acquired two companies.

64

CAP GEMINI SOGETI
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75017 Paris, France
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Cap Gemini Sogeti's strategy of complementing its high growth rate in computer services with judicious acquisitions (financed by a FF1 billion [$183.1 million] war chest) paid off in 1987. Sales were up 38%, at FF4.1 billion ($682.3 million), well above the FF3.6 billion ($591.4 million) target. Net income rose 40% to FF266 million ($44.3 million).

The 1987 figures consolidate the results of firms acquired since the end of 1986, including West German industrial automation firm IBAT, Italian systems house GE-DA, and New Jersey-based Sycomm Systems Corp., a software company specializing in services for the financial and telecom sectors.

During 1987, Cap Sogeti also took over two small French firms: Helias, a Paris-based services company, and ITMI, an industrial automation firm based in Grenoble. In June 1987, the company also acquired a 36% interest in the second biggest French software and services firm, Compagnie Internationale de Services en Informatique, from the French Atomic Energy Authority.

By far, Cap Gemini Sogeti's most important acquisition in 1987 was the purchase of an additional 51% in the Société d'Etudes des Systèmes d'Automation (SESA), a leading networking specialist. Cap Gemini now controls a firm in which it already had a 42% stake. The controlling interest was bought in August from Compagnie Générale d'Electricité. SESA's revenues amounted to FF1.1 billion in 1987, of which five months' revenues are consolidated in the Cap Gemini Sogeti group figures.

The company now has a work force of nearly 10,000 in its operating companies in Europe and, in the U.S., Cap Gemini America (CGA) employs more than 2,000 people in branches across the country. In 1987, CGA generated revenues of some $150 million, about 22% of total revenues.

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ECONOCOM INTERNATIONAL B.V.
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1105 BH Amsterdam ZO
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Frenchman Jean-Louis Bouchard can congratulate himself on founding two companies in 1987's DATAMATION 100.

One of those is French leasing firm Europe Computer Systèmes (ECS), which he began in 1974 and sold to the French bank Société Générale in 1985. The other is Econocom International, a leasing group that now operates in 15 countries and brought in revenues of G1.37 billion ($674.3 million) last year.

Most of those revenues (78%) come from Europe, particularly West Germany, the U.K., and the Benelux countries. As part of the ECS deal with Société Générale, Bouchard was banned from opening a French leasing operation until April 1, 1988. After only a couple of months, that business is already producing strong revenues. Another 20% of last year's business came from the U.S., where its original, once locally focused Memphis-based subsidiary has been greatly expanded. The remaining 2% came from Econocom's operations in Asia, mainly from a Japanese company that began operations in 1987.

Last year, Econocom expanded the roster of machines it handles. The leasing operation dropped its IBM-only

Illustration by Didier Cremieux

policy, adding systems from Honeywell, Unisys, Hewlett-Packard, and, particularly, Digital Equipment Corp. In addition, it began offering printers, terminals, and memory systems. In some countries, Econocom also has pc dealership deals with IBM, Apple, and others.

The software market is growing faster than the hardware market, so the company improved its software offerings in 1987. It sells through two main divisions: Econocom Software specializes in systems software, such as performance monitoring and migration packages; Econocom Expert is a consultancy operation offering a range of AI products that work on machines ranging from pcs to mainframes.

The firm set up 14 different subsidiaries around the world in 1987, and Bouchard hopes for similar growth during 1988, primarily based on the nonleasing areas of the business.

66

COMPUTER ASSOCIATES
INTERNATIONAL INC.
711 Stewart Ave.
Garden City, NY 11530
(516) 227-3300

When it bought its chief rival, Dallas-based Uccel Corp., with a stock swap valued at $800 million, Computer Associates became the top U.S. mainframe software company in 1987 revenues. Combined, the companies produced calendar-year revenues of $648.8 million. CA's 1987 earnings were $60.2 million.

CA has been on an acquisition binge, acquiring companies, absorbing their technology and market shares, and bundling their products with CA's own offerings to build higher-priced, integrated packages. Late in 1986, the company acquired Software International, graphics software company ISSCO, and CGA Computer Inc.'s Top Secret security software product. These acquisitions have broadened the company's product range beyond data center systems utilities and operations management, giving it a presence in applications, graphics, and security software. They have also given CA a piece of the growing Digital Equipment Corp. software market.

Prior to the acquisition, Uccel had undergone a dramatic change for the better. Gregory Liemandt, Uccel's departing chairman, is credited with streamlining its focus, realigning its systems software division, and intensifying sales efforts in the banking arena.

The Uccel acquisition has propelled CA into the dominant position in the job scheduling software market for IBM mainframes and has allowed CA to displace IBM as the number one vendor of security software for mainframes.

Although Wall Street favored the merger, some CA and Uccel users are concerned that CA won't continue to support both companies' products. CA chairman Charles Wang has promised that support and enhancement will continue, but he also says that products may be merged in the future.

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INTERGRAPH CORP.
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Huntsville, AL 35807
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Intergraph Corp. appeared to have solved a major supply problem in October when it acquired the Advanced Processor Div. of Fairchild Semiconductor Corp. from National Semiconductor Corp., but the jury is still out on the long-term results.

The computer graphics company attributed a decline in earnings in its first 1987 quarter to late deliveries of workstations based on Clipper microprocessors from the Fairchild operation. This was reflected in earnings results: revenues were up only slightly to $641 million. Earnings declined to $69.8 million from $70.4 million.

Analysts agree that Intergraph was right to save a key supply source by buying APD, but many wonder whether the company can find enough outside customers for the Clipper chips to make the operation profitable.

Intergraph added 10 new workstations and entered the generic workstation business by offering its 32C line of engineering workstations on an unbundled basis, as Unix-based platforms. To move these in the market, the company began a partnership program with third-party software dealers and it sought oem and var relationships. The company also signed a deal with Digital Equipment Corp. to become a licensed vendor for systems based on the VAX Bus Interconnect.

Intergraph spewed out new products all year, but November saw its biggest announcements: its Intergraph Finite Element Modeling System, which runs under Unix on Clipper-based workstations; a workstation-based software package for managing design and manufacturing information in networked systems; the second generation of its Clipper 32-bit architecture in the Clipper C300; and the extension of the Clipper architecture to the low end with the InterPro 120.

68

BELL ATLANTIC CORP.
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Philadelphia, PA 19103
(215) 963-6000

In the four years since the great breakup, the Baby Bells have made tentative forays into computer businesses. Bell Atlantic has gone the furthest, using acquisitions to stake out big positions in computer maintenance. Total IS revenues in 1987 were $635 million.

In 1986, Bell Atlantic bought Greyhound Capital Corp. for $140 million, its largest computer-related acquisition to date. Greyhound, now Bell Atlantic Systems Leasing, saw revenues of $300 million in 1987, making it one of the top five computer lessors.

Sorbus, the third-party maintenance firm Bell Atlantic acquired from MAI Basic Four in 1985, spent the year warding off IBM's increasingly cutthroat maintenance prices, arranging an entry into the Digital Equipment Corp. marketplace, and selling a big chunk of its business back to MAI Basic Four. IBM's aggressive pricing spells trouble for third-party firms such as Sorbus. The largest third-party maintenance firm in the U.S., Sorbus weathered the onslaught well in 1987, posting revenues of $255 million and exceeding the 12% growth rate of most third-party maintenance firms.

The move into the DEC marketplace reflects the growing number of mixed IS shops, explains William J. Patch, Sorbus' vice president of planning and marketing. Bell Atlantic is also involved in the DEC marketplace through two smaller firms it acquired in 1986: Electronic Service Specialists Inc., the largest provider of carry-in service for DEC equipment, and Technology Concepts Inc., which specializes in DEC communications products.

In February, Bell Atlantic announced the purchase of several European maintenance companies owned by BCE Inc. of Montreal. Bell Atlantic also purchased Camex Inc., Camarillo, Calif. Camex primarily services Control Data disk drives.

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ALPS ELECTRIC CO. LTD.
1-7 Yukigaya-Otsukacho
Ota-ku, Tokyo 145, Japan
(81-3) 246-6076

Alps came to information technology from the component end of the pipeline. The company is one of the top Japanese suppliers of electrical components such as cylinder head units for vcrs, magnetic heads, switches, potentiometers, capacitors, cassette mechanisms, LCDs, CD pickup units, etc., with 21 manufacturing sites in Japan and several overseas. Alps has not attempted to jump directly into the pc market, preferring instead to serve as a supplier of components and peripherals such as printers, floppy disk drives, keyboards, and mouse devices.

The strategy has paid off. Some 24% of revenues, or ¥91.5 billion ($632 million), come from sales of IS products, mainly printers and floppy drives. Alps claims to be the world leader in floppy disk drive production.

As a major component supplier, Alps was squeezed by the strong yen in two ways. First, most Japanese customers insisted on price decreases to help cope with their export pricing problem; and direct exports came under heavy pressure for price reduction. IS product sales also suffered from the semiconductor agreement-related punitive tariffs on pc imports to the U.S., although the growing domestic pc market has provided some relief. Alps has joined a group promoting the development of the AX operating system, compatible with MS/DOS and with Japanese-language-handling capability.

Alps has reacted to changing conditions as most of its compatriots have—by trying to move as much production overseas as possible. It claims, however, that it is not just setting up plants in cheap-labor or politically sensitive locales; rather, its goal is to promote internationalization as an alternative to insularity. Among its overseas plants is one in Garden Grove, Calif., acquired from Apple in 1985, which produces keyboards, mouses, and, since March 1987, 5¼-inch floppy disk drives.

Some IS products are going to a cheap-labor locale, however. Alps Electric Korea now produces printers and floppy disk drives, as well as consumer components.

70

SAMSUNG ELECTRONICS CO. LTD.
7 Soonghwa-dong
Choong-gu, Seoul, South Korea
(82-2) 751-6114

Last year marked the passing of an era for the Samsung Group. Lee Byung-Chull, the founder and chairman of the group, died and was replaced by his son, Lee Kun-Hee. The 47-year-old Lee shares his father's vision of Samsung as a world-class contender in the electronics and aerospace fields.

DATAMATION estimates sales of IS products by the Samsung Group were W468.4 billion ($569 million), an increase of 34.5% over 1986. IS products account for just under 14% of Samsung's total sales.

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The high-tech flagship of the group, Samsung Semiconductor & Telecommunications (SST), increased production of pcs to 35,000 units per month by the end of 1987—nearly doubling its monthly output in a year.

Samsung laptops were introduced at last fall's Comdex show and volume production is expected in late 1988. However, SST and other South Korean manufacturers that hope to mass produce 386-based machines are dogged by design problems—a testament to the nascent state of South Korean systems engineering.

South Koreans bought 18,000 fax machines last year, but SST's share of the domestic fax market slipped by several points after a number of new vendors entered the marketplace. It held a 25% share of the market in 1986.

In 1987, the Samsung Group dedicated a W125 billion ($152 million) R&D center outside Seoul and a $60 million wafer fabrication facility in San Jose. The bulk of SST's R&D resources are poured into semiconductors.

Samsung Electronics Co. claims to have 10% of the world's share of monitors; IBM is an oem customer. Samsung is making a vigorous attempt to lessen reliance on oem orders and develop its own brand. It has made a modest beginning at marketing and advertising its own IBM-compatible pcs and monitors in North America and Europe.

71

COMPUTERVISION CORP.
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Bedford, MA 01730
(617) 275-1800

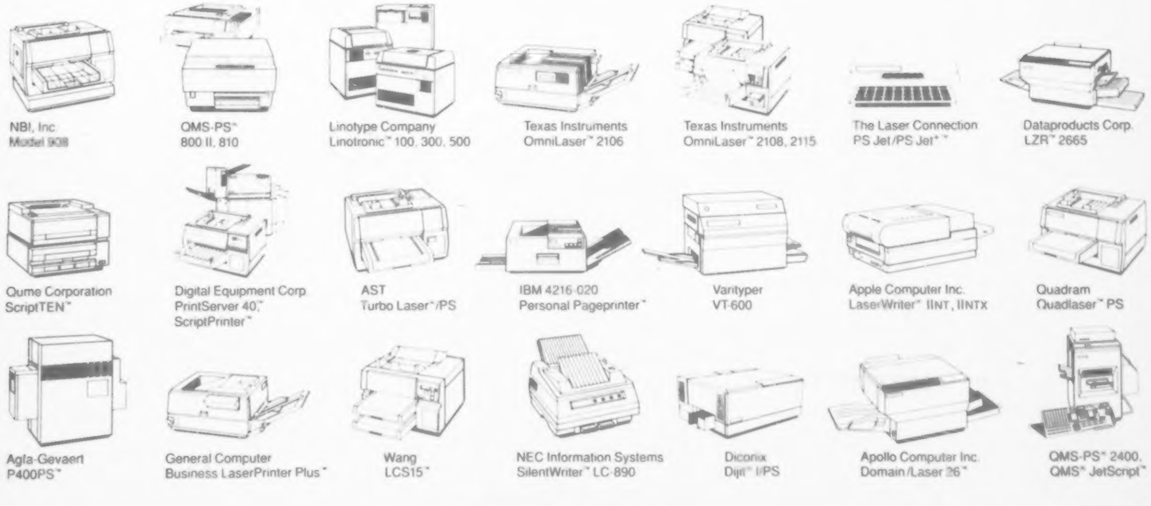
Computervision was poised to show its first yearly growth since 1985, ready to tell its turnaround story to the world. But all that the media wanted to know about was whether the company, CAD/CAM's fallen angel, would resist the unfriendly takeover attempt by Prime Computer. Resistance proved futile. In February 1988, this CAD/CAM pioneer became a division of Prime, and its 1987 return to profitability was deemed minor compared with the possible futures analysts were weaving for this new force in the marketplace.

Computervision's decline began in 1985, a reflection of its failure to migrate its industry-leading software to emerging, nonproprietary, workstations and pcs—something it didn't even begin to do until 1986. Computervision's 1984 revenue of over $556 million would prove to be a high watermark that it wouldn't reach again until the end of 1987, when it topped $564 million. After losses in 1985 and 1986 of $80.8 million and $5.8 million, respectively, the company strode back into the black last year with $19.5 million net earnings.

Customers, especially those in Europe, remained steadfastly loyal through the hard times and are now buying with a vengeance. Sales in West Germany and the U.K. accounted for the bulk of Computervision's overseas sales, which in turn represented more than half of total sales.

Computervision created the CADDStation, with innards built from a

And choose.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QMS-PS™
800 II, 810
Linotype Company
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P400PS™
General Computer
Business LaserPrinter Plus™
Wang
LCS15™
NEC Information Systems
SilentWriter™ LC-890
Diconix
Dijit™ I/PS
Apollo Computer Inc.
Domain/Laser 26™
QMS-PS™ 2400,
QMS® JetScript™

CIRCLE 45 ON READER CARD

4MIPS Sun Microsystems cpu, to meet its customers' workstation needs. During the early part of the year, the lengthy process of moving the CAD 4X software resident on its proprietary CDS 4000 minis to the new workstation was complete—a sign, perhaps, that exile from the mainstream was over. It's significant that during 1987, Toshiba sought and secured the rights to manufacture and sell the workstation in the Japanese marketplace. Later this year, Computervision will deliver new CADDStations featuring Sun's SPARC chip.

Computervision is one of DEC's biggest oems, and it fits neatly into Prime's strategy to become an integrator of other companies' technologies. Prime has its own minicomputer family, but the oem links with DEC will be kept and strengthened. Then there's Unix: Prime and Computervision each are attempting to attract new customers by focusing on AT&T's standard.

72

APOLLO COMPUTER INC.
330 Billerica Rd.
Chelmsford, MA 01824
(617) 256-6600

Apollo's 1987 strategy built naturally on foundations it laid in 1986. The company continued its push into the low-end workstation market and also introduced its set of homogeneous networking products, together called the Network Computing System (NCS).

The workstation manufacturer's sales reached $553.6 million, a robust 41% increase over 1986, which itself saw a healthy increase of 32.5%. Profits, which jumped to $9.3 million in 1986 following a loss in 1985, rose dramatically again in 1987, reaching $22 million, a 133% increase. Apollo incurred a $6.5 million charge against its third-quarter earnings as a result of an unauthorized foreign currency transaction by an employee. R&D spending increased 37% to $61 million, while worldwide employment jumped 11% to nearly 4,000.

At the low end, Apollo introduced the industry's first 4MIPS workstation for under $14,000, an entry-level model Series 3000 Personal Workstation for under $5,000, and a family of pc integration products. At the high end, the DN500 Turbo graphics workstation with 3-D graphics solids modeling applications was unveiled, as were a ruggedized Series 3000 workstation for the factory floor and the Open Dialogue user interface management system.

International sales continued to be strong in 1987, and Apollo made plans to open manufacturing facilities in India, Scotland, and the Far East. Apollo was instrumental in the March 1987 formation of the Network Computing Forum (NCF), an affiliation of over 100 computer firms worldwide dedicated to supporting a variety of network products. Apollo signed deals—valued at $100 million each—with Mentor Graphics Corp., Beaverton, Ore., and West Germany's Siemens AG.

73

LOCKHEED CORP.
4500 Park Granada Blvd.
Calabasas, CA 91399
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Lockheed Corp. glided easily through its second year on the DATAMATION 100. Its Information Systems Group (ISG) brought in revenues estimated at $553 million—a respectable 11.3% climb from its $497 million in 1986.

The biggest revenue generator in the six-company ISG hangar is California Computer Products (CalComp). The Anaheim, Calif., plotter maker, which Lockheed acquired in its purchase of Sanders Associates Inc., brought home an estimated $370 million—more than two thirds of Lockheed's IS revenues.

CalComp's big year was due, in part, to offloading its pc and minicomputer-based CAD systems division to Anaheim-based ISICAD. Charles Foundyller, an analyst who follows CalComp for Cambridge, Mass.-based Daratech Inc., says that the sale enabled CalComp to refocus its sights on plotters. Foundyller says that the streamlined CalComp has been "keeping up with, and, in some cases, even surpassing" its two main competitors, Hewlett-Packard and Xerox Corp.'s Versatec.

Another ISG division that did well in 1987 was Metier Management Systems, the second largest contributor to Lockheed's IS revenues. This was Metier's most profitable year ever, taking in an estimated $92 million. Since 1978, Metier (Houston) has been selling turnkey project management systems for HP's 1000 minicomputer line. More recently, it turned away from such systems and toward off-the-shelf software. Last year, it entered two new markets—microcomputers and Digital Equipment Corp. VAX machines—and expanded its IBM line. Other companies under the ISG wing are CADAM Inc., Burbank, Calif.; Dialog Information Services Inc., Palo Alto; Datacom Systems Corp., Teaneck, N.J.; and Lockheed DataPlan Inc., Los Gatos, Calif.

74

RACAL ELECTRONICS PLC
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Berkshire, England
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In the midst of a shakeout in the U.K. information technology industry, Racal is reaping the rewards of its investment in the U.K. cellular radio business. After six months of fiscal year 1987, Racal reported that over a third of its profits were made by its Vodafone cellular radio subsidiary, and by the 1990s, it could account for half of Racal's profits.

Racal's 1987 IS revenues rose 4.1% to £335.8 million ($549 million). Data communications represents the company's main interest in the IS sector—outperforming the computer aided design and data protection subsidiaries. The Data Communications Group accounted for about 22% of Racal's revenues. Some 70% of this business comes from the U.S., where Racal owns Racal-Milgo, based in Milpitas, Calif., a maker of high-end modems, multiplexors, and successful network management systems; and Racal-Vadic, Miami, which produces dial-up modems operating at up to 9,600bps.

Europe, which accounts for the remaining 30% of communications revenues, is a hotter prospect for Racal. The company has bought a 67.5% holding in Italy's Applicazioni Radio Elettroniche (ARE) from Ericsson subsidiary Setemer. ARE is the top modem supplier to SIP, the Italian telephone company. With the business go three manufacturing sites. In Holland, a new distribution company has been set up. Racal blames the costs involved in these new ventures for reduced datacom revenues.

New products launched by Racal subsidiaries include two local area networks from Milgo. These are TokenNet, a manufacturing automation protocol-compatible product, and RacalLan, which is compatible with IBM's Token Ring network. A systems performance monitoring system called Span has been added to existing Racal network offerings. Racal's network management systems were rated as top of the product pile in a 1987 Datapro survey of U.S. firms.

75

AMSTRAD PLC
Brentwood House, 169 King's Rd.
Brentwood, Essex CM14 4EF, England
(44-277) 211350

In 1987, Amstrad celebrated its 20th birthday with its best results ever. IS revenues of £326 million ($533 million) accounted for well over half of the U.K. electronics company's total 1987 revenues of £590.4 million ($965.3 million). And yet it was not until 1984 that the IBM PC-compatible maker even had a computer in its catalog.

That year, Amstrad launched a home machine called the CPC464. It was quickly followed in 1985 with a standalone word processor system called the PCW8256. Priced at £400 ($650), the word processor was cheaper than most electronic typewriters, and the model sold like hotcakes. The next fall, Alan Sugar, Amstrad's dynamic chairman and managing director, unveiled the firm's first IBM PC clone, the PC1512.

Amstrad had the lion's share of the U.K. microcomputer market last year, selling some 100,000 machines, most of them PC1512s. In volume, Amstrad outstrips all other manufacturers in Europe, although its revenues are lower than IBM's because of Amstrad's bargain-basement prices.

About 60% of the company's business is from overseas markets, with France, Spain, Italy, and the U.S. leading the way. During 1987, Amstrad has moved to put overseas operations on a firmer footing. The company bought its Spanish distributor Indescomp for £22 million ($36 million). In addition, Amstrad opened an Italian subsidiary and bought its U.S. distributor, Vidco Inc.

The Vidco purchase, which involved a cash payment of $2 million, will provide a springboard for increased U.S. sales, Sugar says. He wants to see the United States grow into Amstrad's biggest overseas market by 1989.

Last year, Amstrad launched a portable machine, a new mainstream personal computer for business with improved graphics, and a successor to the PCW8256 word processor. The business pc, called the PC1640, made its debut in the U.S., later appearing in the U.K. market.

Highest on Sugar's hit list is the corporate market. Although some large organizations have bought Amstrad's products, they have not done so in large numbers. A departmental computer is expected from Amstrad this year.

76

COMPAREX INFORMATION SYSTEME GMBH
Gottlieb-Daimler-Strasse 10
D-6800 Mannheim 1, West Germany
(49-621) 40090

Combining the pcm interests of two of West Germany's IS giants, Siemens and BASF, the newly formed Comparex had first-year revenues of DM954 million ($530.8 million) in 1987, just missing its goal of a billion deutsche marks.

Originally a 50-50 joint venture between the two companies, BASF now holds the majority of shares. Comparex will build on the base of users running

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- *Data rates up to 19,200 bps*
- *Internal, external or loopback clock*

FOM-6H
- *Synchronous full or half duplex*
- *Data rates of 56 or 64 kpbs*
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International Headquarters
8 Hanechoshet St., Tel Aviv 69710 Israel, Tel: 972-3-483331, Telex: 371263 RADCO IL, Fax: 972-3-498250

CIRCLE 47 ON READER CARD

IBM-compatible systems passed down by its parent companies, seeking customers for peripherals, software, services, and consulting. According to executive sales vice president Hans-Dieter Jonescheit, "We believe the figures of 1987 prove it is a sufficient base to run a successful business."

While Comparex decided to toe the Hitachi/BASF product line, it managed to allay most of the fears of its Fujitsu/Siemens users with some rapidly developed solutions for incompatibilities in the operating systems. Now Comparex sells Hitachi products exclusively, but it will maintain, upgrade, and resell its Fujitsu-sourced ex-Siemens product lines.

Comparex calls Europe its home market and concentrates on West Germany, the U.K., and France. In addition, Africa, Asia, and South America accounted for 15% of its sales last year. In South Africa, sales through an established deal between BASF and South African agent Persetel were slow.

Comparex updated its 3480-type cartridge tape drives and began development on a new disk storage system—the IBM-compatible 6480-AK7BK—which will have an average access time of 12.5 milliseconds, making it 25% faster than previous models. Comparex was also eager to push its 6385 optical storage archival and storage system, which stores data, text, and graphics on 2GB disks.

77

CSK GROUP
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Shinjuku-ku, Tokyo 163, Japan
(81-3) 344-1811

Last year, CSK Corp. changed its name to CSK Group, a change that heralded its intentions to move away from its role as a supplier of software talent to firms developing customized systems, and to move into systems integration.

Disappointing returns in 1987 made it clear that there is plenty of room for improvement. Since total 1987 financial results reflect revenues both for the CSK Corp. and the several other companies in which it has whole or partial interest, it's difficult to pin down the areas in which performance was poor. DATAMATION estimates that for all the members of the CSK Group engaged in IS, total 1987 revenues were ¥70.4 billion ($486.9 million), with CSK Corp.'s revenues up only an estimated 3.6% in 1987 to ¥53.9 billion ($373 million), and profits rising a mere 1.8% to ¥3.3 billion ($22.8 million). The company blames the uninspired increases in some categories to the shifting of operations to the various subsidiaries and affiliates that make up the CSK Group.

Services, including custom programming and facilities management, continued to be CSK's big money-maker. Service-providing members of the Group include three wholly owned subsidiaries: CSK Research Institute, which develops custom software; Business Extension Group, a provider of facilities management and database services; and CSK Management Services, also a facilities management provider.

CSK Corp.'s leasing revenues were up 8.1% to ¥5.9 billion ($40.9 million), while sales were off 6.8% to ¥13.7 billion ($94.4 million), mainly due to the transfer of sales of used computers to Nippon Total Business Machines, half of which CSK owns. CSK also has a 50% stake in the Computer Software Organization, a packaged software maker.

78

MICROSOFT CORP.
16011 N.E. 36th Way
Redmond, WA 98073-9717
(206) 882-8080

For Microsoft, the highlight of a winning year was the April 1987 announcement of OS/2, the operating system planned to supersede MS/DOS in IBM's new line of PCs. So far, however, OS/2 has been hampered by a lack of applications software that takes advantage of its capabilities. MS/DOS runs on an estimated 10 million PCs and clones; Microsoft receives between $25 and $30 for each MS/DOS sale. For OS/2, Microsoft expects to get between $75 and $100 for each piece of operating system software sold. In 1987, total sales rose 75.5% to $456.7 million, and net income was up 61.5% to $93 million.

OS/2 is just one piece of a large Microsoft pie. The company is developing Xenix, its version of AT&T's Unix operating system for pcs. Through a licensing arrangement, Microsoft aims to own about 80% of the pc Unix market. In October, the company shipped Microsoft Excel, its spreadsheet challenge to Lotus 1-2-3. In November, it shipped Microsoft Windows 2.0, and, in the final month of the year, it shipped IBM OS/2 and Microsoft's OS/2.

The company expects to ship OS/2 LAN Manager in the second quarter of 1988, along with the Microsoft SQL Server (in partnership with Ashton-Tate), and then ship its Unix/Xenix merged product in the third quarter of 1988. Microsoft is working with Hewlett-Packard on a version of Windows, with Aldus to provide PostScript support, with Zenith on an MS/DOS Manager, and with Compaq on Windows/386.

79

XIDEX CORP.
525 University Ave.
Palo Alto, CA 94301
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After years as a powerhouse in the microfilm business, Xidex Corp. turned to other forms of computer storage in the early 1980s and in three years nearly tripled its size. Xidex launched an in-house product line of floppy disks in the early 1980s, and it doubled its size in February 1985 when it acquired Dysan Corp., which also made rigid disks. Xidex reports that it holds 60% of the independent rigid disk market and 25% of the market for flexible disks. Acquisitions have taken the company into computer tape and cartridges, antiglare computer screens, disk drive diagnostic tools, and software duplication. Says chairman and president Lester L. Gilbert, "We moved from an expansion mode to a mode emphasizing greater efficiency and profitability."

But with the size change—from $178 million in total sales in 1984 to almost $600 million last year—came a load of obsolete machinery, excess plant space, and a market so fraught with change that Xidex last year had to spend nearly $11 million in R&D just to keep up. It also recorded its first loss since becoming publicly held in 1978.

While Xidex didn't do too badly in its last quarter of 1987 (reporting $152.6 million in revenues, compared to $146.3 million the year before), earnings of .07 a share were below estimates. It was having yield problems on 5¼-inch floppy disk production and had delayed by 60 days its switch over to an automated production process. So, Xidex began setting aside reserves for its excess real estate and obsolete equipment and began to consolidate and automate its magnetic media manufacturing operations. In so doing, the company took a $62 million loss, which gave it a year-end loss of $48.9 million on revenues of $596.6 million, down from 1986 revenues of $533 million.

80

3M
3M Center
St. Paul, MN 55144-1000
(612) 733-1110

3M likes to say that, each day, half the world's population benefits from its products: everything from Scotch Tape and Post-it Notes to disposable diaper closures and heart-lung machines. Its 1987 annual report lists more than 80 principal products. 3M, which grew 9.6% to $9.4 billion in 1987, sets a goal each year of getting 25% of sales from products less than five years old.

In the computer business, 3M is best known for its 5¼-inch floppy disks, but actually 3M offers what is probably the broadest line of magnetic media products available: 3½-inch diskettes, hard-disk media, ½- and ¼-inch tape and data cartridges. DATAMATION, together with Santa Clara Consulting Group, which follows the magnetic media market, estimates 3M sales from these products at $455 million in 1987, up about 13.7% over 1986 (1986 numbers were restated to reflect worldwide sales). Although 3M declines to break out revenues or earnings for this sector, it is considered one of the company's most profitable lines. However, enormous price-cutting, particularly in diskettes, where it competes with Verbatim, Sony, and Maxell, held earnings lower than the company would have liked.

The area where 3M is focusing a great deal of effort—and where it has an overwhelming market share—is data cartridges. 3M introduced the first ¼-inch data cartridge back in 1971 as a specialty product to compete with reel-to-reel tape. Today, it sees the beginnings of a mass market with the millions of pc hard-disk systems turning to data cartridges for backup.

Freeman Associates, a Santa Barbara consulting firm, estimates that 10 million to 15 million data cartridges were sold in 1987. 3M has virtually all of those sales and it salivates over the fact that it has only reached 10% of the pcs with 20MB hard disks. In a further expansion of its magnetic media business, 3M last year took an equity stake in Logistix of Milpitas, Calif., which does software production and distribution for software publishers and oems.

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Illustration by Didier Cremieux

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HARRIS CORP.
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Melbourne, FL 32919
(305) 727-9100

Harris continued its fine-tuning in 1987, resulting in net income of $92.2 million, sharply higher than its $68.6 million in 1986. However, the company was plagued by flat sales of $2.08 billion for the calendar year. That figure is even less appealing when compared with 1985's $2.3 billion revenue tally.

It is up to ceo John T. Hartley to forge coherence from Harris's hodgepodge of businesses. After a tough 1986, when the employee roster was cut and marginal products were axed, 1987 was to be the year of improved productivity. "We've reexamined the philosophy we've espoused over the years of always going for the bigger and better," says Hartley. "We're now looking at smaller and better."

Smaller was the key word in some instances, as revenues showed. But smaller also meant a tighter rein over Harris's five sectors. Turning around the Information Systems Sector (which produces minicomputers) and the Semiconductor Sector were two goals that saw some success. One black cloud was the Information Systems Sector's report of a "moderate" loss on lower sales for the fourth calendar quarter, the result of reduced shipments initially targeted at government programs. Harris's revenues from computer products fell by 3.9% to $446 million. The firm continues to rearrange the pieces of its computer business, focusing on the CX line of Unix systems, and deemphasizing its older proprietary H Series. Harris officials say that by midyear, the CX family should account for 30% of the Information Systems Sector's sales, up from 1987's 20%.

Earnings apparently were up at the Lanier Business Products Sector, while sales at Harris's Communications Sector were flat at best, partially a result of weaker-than-anticipated satellite and broadcast equipment markets.

82

FINSIEL S.P.A.
Via Isonzo, 21/B
00198 Rome, Italy
(39-6) 851505

Finsiel (Finanziaria per i Sistemi Informativi Elettronici) is Italy's largest software company and one of Europe's top five. It is comprised of 10 firms (Italsiel, Societa Generale d'Informatica, Informatica Friuli Venezia Giulia, Informatica Campania, Sibi, Tecsiel, Informatica Trentina, Intersiel, Agrisiel, and Informatica Calabra) and operates in private and public sectors that include industry, credit, trade, services, and public agencies. Finsiel's largest shareholder is the state IRI Group.

Finsiel experienced strong growth in 1987: 16% growth in personnel and 21.3% growth in revenue to L550 billion ($424.1 million). In a major move to broaden its activities beyond Italy—heretofore its only market—Finsiel opened a branch called Softsiel in San Diego at the end of the year. Softsiel's assignment is to promote the group's products in North America, search out joint venture opportunities, and act as a "technology observatory" to bring new and developing technologies back to the home companies.

In 1987, Finsiel and IRI organized GI Informatica, an ad hoc company formed to serve information technology needs within the entire group. R&D was pushed in 1987 with time and money allocations up 37% from 1986 to L30.1 billion ($23.2 million)—about 5% of total revenues. Heaviest attention is being paid to software production technologies, systems software development, artificial intelligence, and networking.

83

NORSK DATA AS
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The dream began to fade for Norway's minicomputer specialist Norsk Data last year. After 14 years of sustained growth—including a 37% surge in 1986—Norsk's chairman Rolf Skår spent much of last fall warning of a massive drop in profits for 1987. Once known as Norway's "Millionaire's Factory," Norsk reported net profits down 49% to NKr198 million ($29 million) on revenues up 10.4% to NKr2.8 billion ($422.6 million). Share prices plummeted and Norway's millionaire community contracted.

Sales were off in the U.S. and India, slowed during the last quarter in the U.K. and West Germany, and were disrupted by difficulties with the Matra partnership in France. Only in the Scandinavian homelands did Norsk maintain its marketing targets in 1987.

The $25 million purchase of U.K.-based office systems company Wordplex was completed in August. It added NKr165 million ($24.5 million) to the group's revenues for last year.

In France, Norsk renegotiated its 1984 deal with Matra Datasystems, which covered the exclusive manufacture and sale of Norsk's mini line. Matra had subsequently signed other deals with Sun and Encore Computer and Norsk regarded these as too close for comfort. The renegotiated deal gives Matra the nonexclusive distributorship of Norsk's minis in France.

Norsk's major product introduction was the 5000 series of 32-bit systems, an announcement well received by the company's user base. Skår points out, however, that "hardware is not enough any more," and the company is putting considerable force behind its software products, 80% of which come from internal development projects.

Norsk's business picked up in the first few months of 1988, with a revenue increase of 34% in the first quarter. As one Norsk spokesman puts it, "We hope for much better results this year. 1987 was just an accident."

84

CONTINENTAL INFORMATION SYSTEMS CORP.
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Syracuse, NY 13221-4785
(315) 437-1900

The computer leasing industry is consolidating at a record pace. More than 40 mergers and acquisitions have taken place over the last four years—over a dozen since the Tax Reform Act was enacted. High on the list of important takeovers is Continental Information Systems' $105 million acquisition of rival CMI Corp., Bloomfield Hills, Mich., in August.

The merger leaves Continental second only to Comdisco among independent U.S. computer lessors.

Even before the merger, Continental was on its way to a healthy year. Revenues were up 46.6% to $420.8 million (CMI's revenues were counted in the last quarter only). Lower revenues from tax-oriented lease transactions were overcome by increased rental fees and remarketing of used computers, according to Continental's president and ceo Harry Goetzmann Jr.

Profits were harder to come by, however, in the post-Tax Reform era. Continental's net income increased a modest 9.4% to $15.1 million. Return on equity was down to 27%.

The merger with CMI provides Continental with a greater national presence—it now boasts a sales force of over 900 for computers (it also remarkets other capital equipment, including aircraft)—and gives it more muscle for raising capital.

In January 1988, Continental made its first moves outside leasing with the acquisition of Buffalo, N.Y.-based Meszaros Associates Inc., which operates under the name COM-PRO and provides contract programming and other professional services. The seven-year-old COM-PRO has 200 employees and annual revenues under $10 million. Terms of the purchase were not disclosed.

Also in January, Continental acquired Randolph, N.J.-based Aviron Computer Technologies Inc., which refurbishes and reconfigures mainframe computers.

85

EMHART CORP.
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Hartford, CT 06101
(203) 678-3000

Emhart Corp., a $2.4 billion manufacturer of industrial and consumer products, got into the computer business in December 1986 through its $210 million purchase of Planning Research Corp., the Reston, Va.-based software and services firm. Planning Research, with revenues of $438.3 million, accounted for 18% of Emhart's 1987 volume. (Emhart's consumer products accounted for 18% of the company's revenue, and its huge, diversified industrial products sector accounted for 64%.)

In December 1987, a year after the Planning Research acquisition, Emhart (which in the last two years has shed 18 business units) paid $140 million for another computer services company, Advanced Technology Inc. Both buys are part of a massive worldwide restructuring aimed at adding new zing to Emhart's growth rate, which so far has languished at around 2%.

The bulk of Planning Research's revenues are from management services for government agencies. For example, it has a six-year, $60 million contract to automate software development for NASA's space station program and recently it won a $3.4 million follow-on contract to provide professional and managerial services to the White House. The order has a potential worth of $15 million. Planning Research also provides on-line services to 250 U.S. real estate multiple listing services and it provides office management systems to physicians at some 1,400 group medical practices.

Advanced Technology provides similar services to the U.S. Navy. A subsidiary last year won a $9 million contract to update technical manuals for the plant maintenance and the operating staffs of the Tennessee Valley Authority.

86

FERRANTI INTERNATIONAL SIGNAL PLC
Bridge House, Park Rd., Gatley
Cheadle, Cheshire SK8 4HZ, England
(44-61) 428-3644

The merger between Ferranti and International Signal and Control (ISC) of the U.S. to form Ferranti International

Signal was deemed a marriage of convenience: Ferranti's skills in electronics matched International Signal's know-how in rocketry and other military hardware. The combined company, headed by Sir Derek Alun-Jones, is worth more than £600 million ($1 billion).

Ferranti, the number two U.K. computer maker to ICL, continues to wrestle with U.K. defense cuts that have dulled its general purpose IS business. There were redundancies at its Computer Systems Div., which produces the Argus series of computers used on ships, submarines, and in industrial control applications. IS revenues moved up to £243.9 million ($398.8 million) in 1987 from £229 million ($335.7 million) in 1986.

Revenues were helped by a £12.2 million ($20 million) deal to supply CPTE, the Belgian electricity company, with a Ranger energy management system. More recently, the company bagged a deal of about the same size to provide test systems to Martin Marietta as part of the aerospace company's work on the National Test Bed project to simulate strategic defense initiative weapons and missile attacks.

Ferranti sought to broaden its simulation expertise. Although it failed to buy Rediffusion Simulation, a U.K. leader in the field, Ferranti paid a modest $1.6 million to buy Solartron Simulation from Schlumberger Ltd.

Since it sold its chip-making business to U.K. firm Plessey for £29.9 million ($49 million), Ferranti International is increasingly reliant on its Computer Systems Div. Ferranti International's product line got a boost when the company became the first to buy PS/2 computers from IBM; the machines will be sold as part of larger industrial and process control systems as FIS2000s. Ferranti International also signed a cooperative marketing deal with Digital Equipment Corp. for products to be used in Ferranti's energy management systems.

In the U.S., Ferranti bought Pantamation, which provides computer data centers and in-house systems for hospitals. The Baltimore-based company, snapped up for $16 million, has been renamed Ferranti Healthcare Systems Corp.

Also in the U.S., Ferranti bought out GTE Corp.'s 49% stake in Ferranti GTE, the joint venture communications outfit that the two companies set up five years ago.

87

WYSE TECHNOLOGY
3571 N. First St.
San Jose, CA 95134
(408) 433-1000

From its beginnings seven years ago, Wyse Technology has kept to a consistent strategy: high volume, low costs, offshore manufacturing, adherence to industry standards, and carefully targeted distribution.

That strategy, plus some key acquisitions along the way, have earned Wyse the enviable status as one of the fastest-growing companies found on the DATAMATION 100. Revenues grew 74% to $396 million in 1987, while net income increased by more than half to $25.5 million.

Wyse began as just a terminal company. Today, its flagship product, the WY-50, is one of the world's best-selling ASCII terminals, with more than 10,000 units shipped each month. Wyse has expanded its line to include ANSI and low-level graphics terminals. Its acquisition last year of Link Technologies of Fremont, Calif., was an important part of its drive to broaden its terminal product line. The year before, Wyse bought Amdek Corp. of San Jose, which sells monitors.

In 1987, Wyse entered the pc business and now offers a full line of 80286- and 80386-based pcs. They now account for nearly half of the company's product sales.

Wyse's production facilities are located in Hsin Chu, Taiwan, where 90% of the subassembly parts for its terminals and pcs are manufactured. Wyse markets its products through a network of vars, distributors, and oems, including Altos, Northern Telecom, the Ultimate Corp., and Harris Corp.

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LOTUS DEVELOPMENT CORP.
55 Cambridge Pkwy.
Cambridge, MA 02142
(617) 577-8500

The battle for the title of world's largest supplier of software for the pc escalated in 1987. While Lotus and its archrivals Microsoft and Ashton-Tate appeared to be evenly matched throughout the year, Lotus reached a significant agreement with IBM that could have a major impact on Lotus's future growth.

By any measure, it was a good year for Lotus. Revenues jumped a healthy 40% to $396 million from $283 million. The previous year's increase had been 25%. Lotus performed particularly well overseas—international sales increased about 60% over 1986.

Lotus's flagship product—and still its cash cow—is the omnipresent spreadsheet program, 1-2-3. Analysts estimate 1-2-3 is installed in 70% to 80% of U.S. corporations. Through its 10-year agreement with IBM, Lotus is seeking to become even more deeply entrenched in the office. Their pact, announced last fall, calls for Lotus to develop a mainframe version of 1-2-3, which IBM will market exclusively.

New products announced in 1987 included Metro, Lotus One Source, Lotus Express, Galaxy, along with PS/2 versions of HAL and Manuscript, and a version of 1-2-3 for the Macintosh. The new product that garnered the most attention was Agenda, brainchild of founder and former chairman Mitch Kapor, who left his position last year to concentrate on Agenda's development. A "personal information manager," Agenda incorporates AI techniques, and is aimed at helping businesspeople organize personal notes.

89

SHARED MEDICAL SYSTEMS
CORP.
51 Valley Stream Pkwy.
Malvern, PA 19355
(215) 296-6300

Pressure from government and insurance companies to contain health care costs slowed the growth rate of Shared Medical Systems in 1987.

Revenues for the provider of computerized information services to hospitals and other health care organizations had been growing at about 20% a year. Though 1987 revenues and earnings were the highest in the company's history, sales were up only 4.2% to $390.7 million from $374.9 million. Earnings, on paper, jumped to $45.3 million from $32 million—however, the 1986 figure had reflected a one-time, $20 million write-off for discontinued operations in Japan; SMS's real direction was down, by about 13%.

Last November, SMS formed a division dedicated to the development, marketing, installation, and support of health information systems based on Digital Equipment Corp. computers. Called the Turnkey Systems Div., it took over responsibility for marketing and installing the company's SPIRIT hospital information system for DEC VAX computers, which integrates financial, clinical management, and departmental applications. SMS is a member of DEC's Reseller Business Council and serves as a field test site for a variety of DEC hardware and software products. Earlier in the year, it had added DEC's MicroVAX 3500/3600 systems to its product line.

90

CONVERGENT TECHNOLOGIES INC.
2700 N. First St.
San Jose, CA 95150-6685
(408) 434-2848

After losing $32.8 million in 1986, Convergent Technologies went on to lose another $32.6 million in 1987, even though its total revenues grew a healthy 25.8% to $384.8 million. The source of the loss was the startup of a new subsidiary, Convergent Business Systems Inc., a federation of nine acquired companies. The new subsidiary accounted for nearly 36% of Convergent's sales in 1987. Its operations are aimed at vertical markets, such as automotive repairs, legal, construction estimating, building materials, automotive dealerships, accounting software, beverage distribution, and small business systems. The company also created a national customer support service, a leasing company, and a supplies company.

The founding of CBSI was a reaction to Convergent's lack of success in selling network-based computer systems to oems, such as AT&T, Unisys, NCR, Bull Transac, and ADP.

Going after vertical markets via acquisitions cost big money, though. For example, CBSI had to be reorganized so that each vertical market was getting the full attention of a separate company, according to a year-end report from chairman Paul Ely Jr. "Many changes were made to accomplish this: companies were consolidated, others were separated and realigned." Ely noted that one benefit of the move was the removal of a layer of management.

Despite all of the turmoil associated with changing a company's customer base from 100% oem to essentially 50% end user, Convergent has a net cash position of $30 million (which should soon be improved by the sale of another subsidiary). Analysts say that, barring unforeseen buyer trends, "positive results are expected."

91

NOKIA CORP.
P.O. Box 780
SF-00101 Helsinki, Finland
(35-8) 05671

The data systems division of Finland's massive trading group, Nokia Corp., is hungry. Strengthening its market share in the workstation sector and snapping up a major Scandinavian competitor, Nokia last year laid the foundation for a significant buildup of its IS business.

Nokia's IS performance reflected its ambitions. Revenues were up 19% to Fmk1.65 billion ($375.3 million). Profits from IS hit Fmk668.2 million ($152 million), representing over half of the Nokia Group's Fmk1.2 billion ($278 million) total profits.

Most of those sales came from its workstation and microcomputer business, followed by datacom equipment, maintenance, minis, and mainframes. All of Nokia's sales were in Europe, with particular strength in Sweden and the West German public sector.

During the year, the company launched its AWS line of workstations and, under a distribution deal with Honeywell Bull, introduced the DPS 6 and DPS 8000 lines to Finland.

Bolstered by its strong sales performance, Nokia's management spent the last few months of 1987 planning the most important takeover in its history. The target was the information systems division of Nokia's neighboring electronics giant, the veteran Swedish firm LM Ericsson.

By early 1988, the deal was completed, creating a new IS force with revenues of $1.1 billion, 8,000 employees, 70% of its business in export markets, and a goal to move from Europe's number two workstation supplier to number one by 1992.

92

TANDON CORP.
20320 Prairie St.
Chatsworth, CA 91311
(818) 993-6644

Last year was one of focus for Tandon Corp., a company that found fame and fortune in the early 1980s as a major provider of disk drives, primarily to IBM. When its IBM sales fell off, the company sought other sources of revenue, including building its own personal computers. In 1987, it sold its disk drive business to concentrate on pcs.

Revenues for the year, including the discontinued disk drive business, totaled $374 million, with earnings of $10.3 million.

After manufacturing personal computers for Tandy Corp., Xerox, and Siemens, Tandon introduced its own brand in the U.S. two years ago. Its latest models are based on the 80286 and 80386 chips, and, in spite of IBM's introduction of the PS/2 line last year, Tandon's computer has done well, especially in Europe where it was first introduced. At the end of the year, it had a $90 million backlog of orders from retail dealers, compared with $25 million the year before.

Until it sold its disk drive business, which essentially comprised Winchester-type products, its computer business represented 60% of the company's revenues, with disk drives totaling 40%. Tandon, however, found itself strapped for working capital, despite strong sales of its computer line. The company spent most of 1987 looking for ways to improve its cash position. Competitive pricing in the disk drive market, lower margins on its IBM XT-compatible personal computers, and higher freight costs to ship products overseas ate away at its earnings. In addition, the company settled securities class action lawsuits against it for $5 million during the year.

93

SONY CORP.
7-35 Kita-Shinagawa 6-chome
Shinagawa-ku, Tokyo 141, Japan
(81-3) 448-2244

The big IS news from Sony in 1987 was NEWS, a 32-bit Unix workstation that it claimed grabbed some 15% of the home market. NEWS sales are more impressive than sales of similar products by such rivals as Fujitsu and Hitachi. While

Illustration by Didier Cremieux

overall Sony sales rose less than 4%, DATAMATION estimates Sony's sales of computer products increased 10% to ¥52.9 billion ($365.5 million).

Several factors contributed to Sony's success, but one of them could have been seen as a weakness—a lack of heavy-duty software staffing. Having to go outside to have applications developed meant that Sony was tapping virtually the only high-tech field in Japan where entrepreneurship has begun to flourish—microcomputer software.

It also chose its target markets carefully. Instead of going head-on with the established leaders, Sony made its mark in computer aided software engineering. Desktop publishing—a true cutting-edge technology in Japan, where most business correspondence was still handwritten as recently as the early '80s—was another major growth area.

Sony also broke with the herd instincts of most of its Japanese competitors by going with Berkeley 4.2 Unix rather than System V. Sony credits its choice of Berkeley 4.2 with the overwhelming support it received among software developers and university users. The key factor may have been price, though. The bottom-end model sold for a mere ¥950,000 ($6,568), not much higher than many top-level pcs.

94

MINISCRIBE CORP.
1861 Lefthand Circle
Longmont, CO 80501
(303) 651-6000

DATAMATION 100 rookie MiniScribe Corp. has posted impressive statistics. Revenues for the disk drive maker in 1987 were $362.5 million, a 96% improvement over 1986. Income for 1987 was $31.1 million, up 37% over 1986. The company appears on the list of the top 15 DATAMATION 100 companies in return on assets and has experienced 11 consecutive quarters of growth, including 1988's first quarter.

MiniScribe first made its name as a supplier for the IBM XT. By 1983, with IBM accounting for 61% of its revenues, MiniScribe had become the second largest supplier of 5¼-inch drives. When IBM ended the deal, MiniScribe managed to refocus itself, scrambling to form strong relationships with oems and distributors. The company now does business with Apple and Compaq.

Analysts are impressed by MiniScribe's robust presence in three product areas: 3½-inch, 5¼-inch full-height, and 5¼-inch half-height disk drives. The 3½-inch market promises the best opportunities for growth and now accounts for 45% of the company's business, up from 15% in 1985.

In 1987, MiniScribe eliminated a potential thorn in its side when it settled a lawsuit brought by Rodime plc charging patent infringement. The company will not discuss terms of the settlement.

MiniScribe bucked the trend to reduce staff, increasing its personnel total by 87%. On the other side of the coin, the company operates a fully automated plant in Singapore. It is expected to expand its Far East presence.

95

DIEBOLD INC.
P.O. Box 8230
Canton, OH 44711
(216) 489-4000

Two years ago, the market for automated teller machines skidded to a low of 8,033 units from its peak in 1983, when some 14,000 units were shipped. In 1987, the market edged back up to 8,800 and Diebold Inc., the ATM market leader, got about half of it. That helped boost its sales of computer products in 1987 by 6.1% to $345.5 million. Earnings of $35.8 million were up slightly from the previous year's $34.9 million.

What excites business analysts this year is the company's healthy cash position of around $200 million, its growth in international markets, and the revival in the company's traditional markets. Eighty percent of Diebold's revenue is from the banking business, where it holds about a 22% share of the fast-growing bank electronic security market along with its 45% share of the ATM market.

Diebold also makes interactive terminals through which consumers can obtain information and buy tickets for events. It recently introduced videocassette rental machines and it sells terminals for cashless, automated gas stations. Last year, it sought to strengthen its sales overseas, where Wang and Philips now market Diebold machines. International sales, which in 1987 accounted for about 5% of revenues, are expected to grow to 25% in two years. Sales to the government are rising: there are plans to use ATMs to distribute Social Security checks, and the Navy is thinking of installing some 400 Diebold ATMs in the U.S.

96*

MAI BASIC FOUR INC.
14101 Myford Rd.
Tustin, CA 92680
(714) 731-5100

MAI Basic Four had another good year in 1987 with a profit of $23.9 million on revenues of $334.2 million, compared with 1986 earnings of $10.4 million on revenues of $287.9 million. While William B. Patton, MAI's president and chief executive officer, says he noted some softness in U.S. sales in the wake of the Oct. 19 stock market crash, there is good reason to be bullish over the 1988 outlook for this supplier of computers to small business.

Last year's gain reflected strong sales of MAI Basic Four's 32-bit supermicrocomputers and the acquisition of 23 software, computer maintenance, and distribution companies. Patton says the company posted strong gains overseas.

In January 1988, the company paid $148 million to acquire two computer-related businesses: MAI Canada Ltd. and part of Sorbus Inc. from Bell Atlantic Corp., Philadelphia. MAI Canada was sold to Bell in 1985 as part of a leveraged buy out of Basic Four from corporate raider Asher Edelman, who had taken over control of MAI Basic's parent, Management Assistance Inc. The buy out was made by New York investor Bennett Lebow. Lebow then brought in Patton, a veteran Honeywell computer marketing executive, as president and ceo to turn Basic Four around after four years of losses. The company made a profit in its first year under the new ownership.

96*

DATAPRODUCTS CORP.
6200 Canoga Ave.
Woodland Hills, CA 91365
(818) 887-8000

A quick look at the numbers might indicate that Dataproducts Corp. had little reason to celebrate its 25th year in business. The printer manufacturer lost money in 1987 on disappointing revenues of $334.2 million, down from $350.8 million in 1986. Losses of $3.6 million in calendar 1987 make for an unhappy comparison with earnings of $12.8 million in 1986, which, in turn, had marked a heartening change from a loss in 1985. But quick looks don't tell all.

*MAI and Dataproducts are tied for 96th place winner. Revenues were $91.2 million, up from $84.8 million for the same period in 1986 and its highest in seven quarters. Earnings didn't fare as well: at $1.1 million, they were down from the $2.1 million tallied a year earlier.

The biggest contributor to the losses in calendar 1987 was the July acquisition of Imaging Solutions Inc., of Brookfield, Conn.—formerly known as Exxon Printing Systems Inc.—from Reliance Electric Co. The acquisition put Dataproducts squarely into solid ink and liquid ink-jet printing technologies, joining its existing positions in laser printers and thermal transfer printers.

Dataproducts landed a number of prized oem contracts in 1987, including a multiyear agreement with Unisys, which is expected to produce $65 million in revenues. Another multiyear agreement, with Siemens, ultimately promises revenues of $30 million.

98

DATAPOINT CORP.
9725 Datapoint Dr.
San Antonio, TX 78284
(512) 699-7000

After a four-year absence, profitability returned to Datapoint in 1987: it earned $15.3 million, compared with a loss of $1.8 million in 1986, even though revenues did drop slightly, to $320.7 million from $325 million.

The company had already turned the corner when, in June, it brought on a new chief executive, Robert J. Potter, who had been group vice president of Northern Telecom. Potter relieved Doris D. Bencsik, who had been acting ceo since the beginning of the year. Bencsik, credited with the company's return to profitability, stepped down from active participation in the firm in September 1987, but she remains a member of the board of directors.

Still very much a part of Datapoint is its chairman, corporate raider Asher Edelman, who took over the company in early 1984 and has kept it on a variety of legal calendars almost continuously since that time. The latest lawsuit pitches Edelman against former Datapoint counsel Richard Neville.

Datapoint announced a number of performance enhancements for its ARCnet products during 1987 and, in September, it joined forces with Communications Solutions Inc., San Jose, and TITN Inc., Hayward, Calif., to develop a communications gateway for ARCnet, compatible with IBM's SNA and the Open Systems Interconnection architecture.

99

TEKTRONIX INC.
14150 S.W. Karl Braun Dr.
Beaverton, OR 97077
(503) 627-7111

For nearly all of its 41 years, Tektronix had done well as a company of engineers selling to engineers. Ever since 1984, however, Tektronix sales and earnings have been flat in spite of such corrective steps as big layoffs—2,000 last year and another 1,000 this winter—a product blitz, and a successful manufacturing productivity campaign.

In 1987, sales of terminals and other computer products dropped more than 8% to $320 million, even worse than the 5% drop the firm endured in 1986. Net income plummeted by more than half to $25.7 million. Earnings were up most of the year, then sank like a rock in the last two quarters of 1987, off by 88% and 72%, respectively.

Clearly, drastic steps were required. The answer was new blood. On Nov. 1, 1987, the company appointed a new chairman, Robert W. Lundeen, who had retired the year before at 66 from the chairmanship of Dow Chemical. It named a new president, marketing whiz David P. Friedley, 48. He had been a vp in charge of Tektronix's communications group, which is one of the firm's most successful, accounting for 20% of sales and posting 15% annual growth.

Within three months, Friedley reorganized the four groups that made up the company and added a fifth group to address microwave products. He cut staff and replaced four veteran vice presidents in key areas with executives in their 30s. The company's computer aided engineering business and its computer aided software engineering operation were sold in late March 1988 to Mentor Graphics Corp. at a fire-sale price of $5 million. Tek paid $75 million to acquire the CAE operation in 1985.

Among the company's 60 new products in 1987 and early 1988 was a line of eight engineering workstations and five new graphics terminals. Analysts say the workstations compare favorably with similar products from Apollo Computer, Sun Microsystems, Hewlett-Packard, and DEC.

100

GOULD INC.
10 Gould Center
Rolling Meadows, IL 60008
(312) 640-4000

Gould, still in the throes of a difficult streamlining, managed to inch its revenues up 2.7% in 1987 to $933.4 million. Losses were down, to $95.6 million in 1987 from $101.8 million in 1986. DATAMATION estimates Gould's 1987 IS revenue at $299.3 million, up 3.2% over the year before.

In 1987, the NP1 superminicomputer finally began to ship. It is the first model of the NPL supermini family geared for compute-intensive, real-time scientific applications. Gould was late in publishing benchmarks for the machine, and sales lagged. But the company reports that at the end of March 1988, 46 units had been shipped. Shelton James, vp of information systems at Gould, admits that "if this was two years ago, I would have hoped sales would be a little better than they are now." He points out, however, that "since the publication of the benchmarks, sales have improved," and he expects Gould to sell up to 100 units in 1988. Unfortunately for the company, it is selling the NP1 into a fiercely competitive market, with narrow margins.

Two products introduced in 1986 are still doing well. Sales of MicroSel, a distributed computer system for simulation, are more than $50 million a year, and an image processing system, called the IP 9000, is selling 125 units a year.

Activities in Gould's information systems segment occurred against a backdrop of reorganization, financial maneuvering, and divestiture. James McDonald replaced longtime chief William Ylvisaker as head of the company. McDonald continued a five-year plan to divest Gould's nonelectronic businesses, extending the policy to defense businesses. Potential buyers became wary due to uncertainties that surrounded a $130 million write-off Gould had taken in 1986, and the company was forced to accept lower prices for its divisions than it had hoped. It also took a $115 million charge for the fourth quarter of 1987 as a result of tax and product liabilities and losses in its military operations. In the fall, the General Services Administration suspended Gould's Imaging and Graphics Div. from government contract activity, citing pricing manipulation. ■

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THE DATAMATION 100

Macroeconomic Views

WORLDWIDE PICTURE

Experts from think tanks in the U.S., Japan, and Europe describe the world's major information technology markets.

In the world of IS, the U.S. still carries the most weight and market muscle. Japan, with its growing prowess in semiconductor production, is gaining strength in the worldwide market, while Europe, fueled by its 1992 common market goal, is making headway in terms of strategic IS planning. Forty of the firms in the 100 club are non-U.S. companies: 22 from Europe, 16 from Japan, and one each from South Korea and Canada. Three macroeconomic views—from the U.S., Japan, and Europe—are provided by experts from the Brookings Institution, Mitsubishi Research Institute Inc., and the European Commission's Directorate General for Telecommunications, Information Industries and Innovation. Their reports put the hardware and the high-tech hopes of the world's systems stars in context, attesting to a market and an industry whose increasingly global scope has far-reaching economic impact.

Illustration by Darryl Ligason

The U.S. Computer Industry: A Time of Transition

BY KENNETH FLAMM

In a little less than 40 years, the American computer industry has gone literally from nothing to an industry that holds a critical position at the very heart of the U.S. economy. By the 1990s, hardware shipments alone will represent 2% of the GNP. What has driven this astounding growth is rapid and continuous technological change—change that has dramatically altered the economics of the industry. The cost of information processing capacity has been declining for decades at an average rate of about 25% per year, relative to the cost of all goods and services produced in our economy.

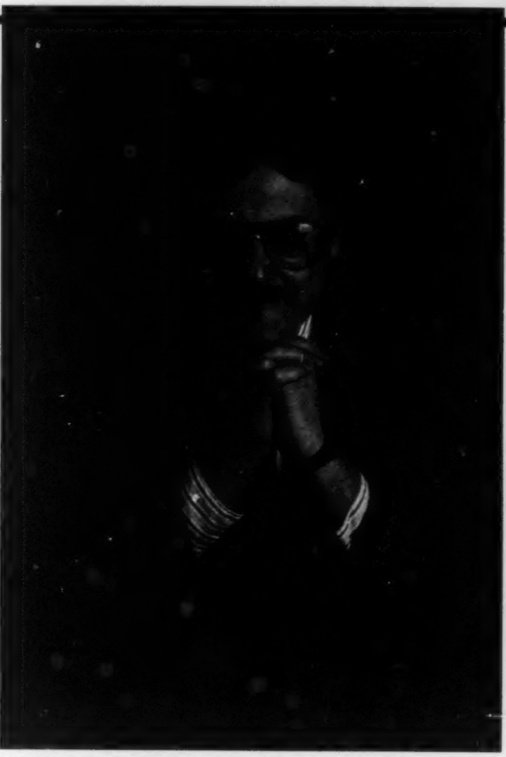
This unprecedented, sustained decline in the cost of an economically important good overshadows by an order of magnitude the changes in the relative prices registered at the peak of the first great industrial revolution two centuries ago. A crude calculation, taking 25% of 2% of the gross national product, results in an estimated benefit to the U.S. of roughly .5% of the GNP, which results from just one year's technical advance. More sophisticated calculations suggest a benefit in the range of .3% to .8% of the GNP. Those percentages are indeed significant in an era when annual GNP growth rates are hovering at between 2% and 3%.

The concerns of the computer industry mirror broader questions that address the future of high technology in the American economy. Computer makers, which, on average, invest more than 12% of their sales in research and development every year, comprise one of the most high-tech commercial industries in our economy. Only aircraft and missile manufacturers, with their heavy defense work, plow greater portions of their sales into R&D.

In fact, the U.S. computer industry was born as a result of the unprecedented national investment made in technology in order to fight World War II. When the commercial significance of this industry became clear in the 1960s, many industrial countries embarked upon crash programs to develop national computer industries. Yet, today, only the Japanese, with their prowess in semiconductor production, pose a substantial challenge to continued American dominance of what is now clearly perceived to be the most important industry in the world.

In 1988, the American computer industry faces three major issues that will dominate development over the next decade. First, the strategies that firms use to compete against each other are undergoing fundamental change. During the 1950s, when companies were learning a brand-new kind of business—that of high technology—massive R&D invest-

(continued on page 146)



FLAMM: By the 1990s, computer hardware will be 2% of the GNP.

The Japanese IS Industry: Moving Toward Strategic Nets

BY KOU ISHII

Japan's information systems industry continued its steady growth course in 1987, despite the sharp appreciation of the yen against the dollar. Total production in the Japanese computer industry increased 13% to ¥4.21 trillion ($29 billion), while domestic demand also grew 13%, hitting ¥3 trillion ($20.7 billion).

The upsurge in computer production was fueled by the increasing demand in Japan for corporate information networks. The mainframe, mini, and office computer sectors shot up a total of 18% as a result of this information network boom in Japan. Personal computer production, however, inched up only 5%. This

ISHII: Japan's IS trade surplus was $8.3 billion.

The European IS Industry: Breaking Down the Barriers

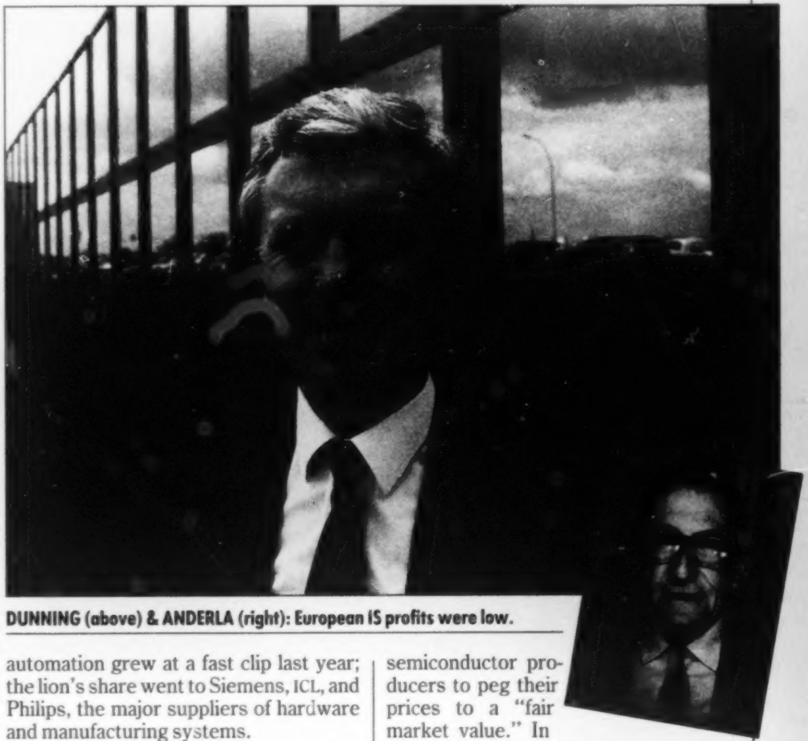
BY ANTHONY DUNNING AND GEORGES ANDERLA

Despite the international crosscurrents and contrary winds that buffeted the European information technology industry, it held its ground and even managed to make headway on certain key fronts. That gain came from the strong push toward factory automation, the further consolidation of the software and services sector, and the resurgence of semiconductor design and production.

Although total sales in the European information technology market were up, aggregate corporate profits were disappointingly low. But, while most vendors suffered, several second-tier players, such as Britain's micro maker Amstrad, enjoyed great success.

Measured against the declining dollar, however, the revenues and income statements of European firms appear artificially inflated, which explains why so many non-U.S. companies have risen to the DATAMATION 100 ranks.

Total European spending on factory automation grew at a fast clip last year; the lion's share went to Siemens, ICL, and Philips, the major suppliers of hardware and manufacturing systems.


DUNNING (above) & ANDERLA (right): European IS profits were low.

Expenditures on factory automation have been growing at an annual rate of 18%—topping the U.S. rate of 12% and the Pacific Basin rate of 13%—rising to $7 billion last year from $3 billion in 1982.

Several companies in the traditionally strong European software and services sector further consolidated their positions through mergers in 1987. Cap Gemini Sogeti fortified its position as Europe's largest services and software vendor by absorbing Société d'Études des Systems d'Automation (SESA). The French firm scored a 44% jump in total revenues and consolidated net earnings last year as a result of the merger. Swiss firm Inspectorate International extended and consolidated its international grasp of the leasing business, absorbing the U.K.'s United Leasing and IBL.

While currency fluctuations and their consequences for computer vendors received considerable attention, in 1987 those currency changes did not have the implications or the global, long-term impact that the juggling of chip prices by the U.S. and Japan did.

In July 1986, in response to the public clamor against cheap Asian imports, the Reagan Administration got Japanese semiconductor producers to peg their prices to a "fair market value." In principle, those prices were supposed to be based upon actual production costs, but they were, in fact, determined by the U.S. Department of Commerce.

Prior to 1986, average world prices for DRAMs were decreasing annually by between 20% and 30%, opening up new opportunities for cheaper, faster processing speeds. But the 1986 U.S.-Japan pact shattered those prospects, and the price of mass-produced chips more than

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sluggishness, caused by the dramatic decline in exports, resulted from the retaliatory duties imposed by the U.S.

Last year, Japanese computer exports reached ¥1.41 trillion ($9.7 billion). Peripheral devices scored the strongest growth gains at 14%. Mainframe exports held steady at 5%. IS imports were up a scant 5% to ¥200.1 billion ($1.38 billion), despite the yen appreciation.

These figures widened Japan's trade surplus in computer equipment to ¥1.2 trillion ($8.3 billion).

Not included in the import/export totals are revenues produced by Japan's information services industry, which expects to increase sales by 15% during the current fiscal year. Roughly ¥2 trillion ($13.8 billion) worth of communications equipment was produced in Japan during 1987, which represents a substantial 15% increase. This stepped-up production reflects the stronger demand in Japan for facsimile machines and PBXs and the pro-

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U.S. Computer Industry

(continued from page 144)

ments in technical innovation quickly became the cornerstone of competition in the industry. At IBM, for example, annual R&D spending, which represented about 15% of net income in the early 1940s, accounted for 30% of its net in the late 1950s. By the mid-1960s, that figure climbed to 50%, an R&D spending percentage that remains roughly the same today.

Also during the 1950s, rapid changes in technology made product differentiation a viable strategy for entry into the computer industry. Companies began to offer systems specifically tailored to serve emerging applications. This was a sensible way to enter the business—sensible as long as new niches, created by the declining costs of computing, were constantly being carved out.

The costs of R&D, however, are relatively fixed, whether you deliver five systems or 50,000. This means that as a producer you can lower the unit cost of your system if you can spread your R&D costs over more than one market. In the jargon of economists, there are economies of scale and scope in the utilization of R&D investments. This is also the reason that the computer industry, like other research-intensive industries in the high-tech arena, has always reached out to the international marketplace, searching for the widest possible market in which to earn a return on the R&D investment.

In the 1960s, IBM used a new business strategy based upon maximal exploitation of economies of scale and scope to freeze its already firm leadership position in the computer industry. The System/360 squeezed the greatest possible mileage out of its own technology investments and those of its computer users. IBM did that by introducing proprietary standards for all hardware and software used in its computers.

The development of standards for an entire product line was a huge commercial success for IBM. Some competitors coped by trying to out-IBM IBM, coming out with a rival standard that targeted the giant's established markets. Others endeavored to produce products that were compatible with an ever-changing IBM standard. Still others continued to go after new markets, where high performance on specialized tasks counted for a lot. In those markets, there was no existing software base that would make users worry about jettisoning the old standards. It was here, at the edges of IBM's empire, that a successful competitor could eventually attempt to penetrate the leader's established markets.

The late 1970s saw the emergence of a radically new development—the creation of nonproprietary, industrywide standards. The flagship of this movement was Unix, launched by chance through the generosity of Bell Telephone Laboratories. Unix, which was later developed under federal contract, was given added push by new software that was written at American universities.

Today, efforts to develop other nonproprietary standards such as OSI have been snowballing. IBM rivals in Europe, Japan, and the U.S. have been rallying together around the flags of both Unix and OSI. The threat to IBM was intensified in the 1970s, when the company strayed from its single-standard policy—a major error for which it is still paying dearly.

COMPUTER MAKERS INVEST MORE THAN 12% IN R&D.

The second major challenge that the U.S. computer industry confronts is the changing constellation of forces in international markets. Nations as well as companies have gotten into the standards act. Out in the world today, there's a complex floating crap game of multinational coalitions that have been set up to support the movement toward international industry standards. The recent proliferation of strategic international alliances among individual firms, in both technology development and in marketing, further confuses any attempt to define what actually is or is not in a country's national interest.

For better or for worse, today's computer industry is inexorably becoming internationalized—so much so that it has become exceedingly difficult to act against a foreign company without damaging a national ally. A good example here is the defense of Toshiba offered by its American customers and competitors over trade sanctions.

The final issue concerns the basic assumptions that are guiding national policy in high technology. The U.S. is facing a world that is increasingly competitive, a world of technological peers and rivals in which the bang-per-R&D buck is more relevant than ever. The U.S. needs to adopt a conscious and considered approach to building a technological infrastructure for its high-tech industry.

Japan's approach to technology investment focuses on commercial relevance, encouraging cooperative action by business, universities, and government in research areas where private returns are likely to fall short of social rewards. The visibly high payoff of Japan's successful strategy is prompting some serious rethinking about how the U.S. goes about investing in new technologies. Relying on accidental spillover from military R&D may have worked out just fine in an era in which the U.S. had no serious technological competitors. That was also a time when the sums the U.S. spent on technology vastly exceeded all foreign expenditures, a time that has clearly passed.

U.S. commitment to open, competitive international markets is central to the success of its computer industry, which sells 40% to 50% of its products in foreign markets. Today, that commitment hangs in the balance. The U.S.-Japan semiconductor trade pact of 1986 and the DRAM crisis of 1988 seem to have cemented into place a system of "managed trade" for a critical high-technology good. The scheme, fixing price floors in market shares by bureaucratic fiat, comes courtesy of the U.S. Department of Commerce, with cartel management services provided by Japan's Ministry of International Trade & Industry.

A society whose economic future is wedded to high technology must create a system to invest efficiently in its technological base, sharing the burden of that investment equitably among all who draw on it, nationally and internationally. It should also work to open up, not close down, international markets that are so essential for continued growth in technology-intensive industries.

Kenneth Flamm, an economist specializing in high-technology industries, is a senior fellow at the Brookings Institution in Washington, D.C. He is the author of Creating the Computer: Government, Industry, and High Technology *(Brookings, 1988) and* Targeting the Computer: Government Support and International Competition *(Brookings, 1987).*

Japanese IS Industry

(continued from page 145)

curement of communications equipment by Nippon Telegraph & Telephone (NTT), which registered a 4% hike in sales during fiscal year '87. Meanwhile, international communications provider Kokusai Denshin Denwa (KDD) posted a 9% rise in revenues.

Foreign computer companies also have been doing well in Japan. IBM Japan's sales hit the ¥1 trillion ($6.9 billion) mark and Nihon Digital Equipment Corp., which has always relied on imported products, began gearing up to assemble midsize minicomputers and workstations in Japan. This April, Nihon Univac and Burroughs combined forces to become Nihon Unisys, getting a new lease on life in the Japanese computer market.

Expansion at the high end of that market boosted sales for such machines as ETA Systems' supercomputer. The boom in workstations in Japan was likewise reflected in the higher revenues of Nihon Sun Microsystems and Apollo Japan. But the most spectacular sales surge of all was chalked up by nonstop systems supplier Nihon Tandem. Once again, the move toward corporate information networks fed the hearty demand for nonstop computers in Japan.

Last year saw more and more corporate IS users tapping into this trend, building their own strategic information networks. Fostering this trend in Japan was the recent deregulation of the domestic communications industry and the increasing usage of high-speed, digital circuits.

What really triggered the trend toward information networks, however, was the move by Japanese manufacturers and distributors to install strategic systems that would enable them to build more efficient operations and to better service their customer bases.

Some of the companies that have set up these strategic systems include household products company Kao, parcel delivery service firm Yamato Transport, department store Marui, and 7-Eleven Japan.

Some big corporate users in Japan are also getting into the information systems industry by spinning off their IS departments into separate businesses. Nippon Steel Corp. is a prime example here. In addition to its joint venture with Concurrent Computer, Nippon Steel also has established a company in the information services field, in partnership with IBM Japan, Hitachi, and C. Itoh & Co. Ltd.

Real growth of 4.2% in the Japanese economy was fueled by increased government spending on construction projects in 1987. The Mitsubishi Research Institute forecasts that the Japanese economy will grow 3.2% in fiscal year '88, a healthy expansion compared with the economies of other industrialized nations, which are expected to hover around the 2% mark.

The U.S. economy is hobbled by twin deficits in trade and in the budget. The resulting loss of confidence in the U.S. economy, coupled with the fact that there are currently no effective measures to deal with the problem, will accelerate the appreciation of the yen against the dollar. The average exchange rate for 1988 is expected to be ¥123 to $1.

Japan's trade policy will be more firmly based upon the principles of open trade. In the data processing arena, Japan's Ministry of International Trade & Industry (MITI) will continue international collaboration on Open Systems Interconnection (OSI) standards and on the development of machine translation technology. During 1988, the U.S.-Japan Semiconductor Agreement will also be the subject of ongoing discussion.

HIGH-END MACHINES BOOM IN JAPAN.

The information systems industry in Japan will achieve an annual growth rate of more than 10%. Investment in IS technology should hold steady, since big corporate users in Japan now consider information networks as one of the essential elements in their marketing strategies.

There are three overriding issues that the Japanese computer industry likely will have to resolve for the future. The first concerns the inroads that the laptop computer is making into the office environment. Second, Japanese companies that have been big exporters of IS products will be expanding their on-the-spot production facilities in consumer countries such as the U.S. Third, Japanese computer vendors will have to perform a delicate balancing act between protecting the intellectual property rights of their software and maintaining compatibility with IBM's next architecture.

Kou Ishii is senior staff researcher in Tokyo's Industrial Research & Consulting Department at Mitsubishi Research Institute Inc., which describes itself as a "nonpartisan organization."

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CIRCLE 55 ON READER CARD

European IS Industry

(continued from page 145)

doubled within a year. While processing power is dearer as a result, U.S. and Japanese semiconductor vendors have been able to increase their earnings as a result of the agreement. The favorable fallout was felt in Europe as well, where overall chip sales increased to $6 billion last year, compared with $5.4 billion the year before.

The U.S.-Japan pact also gave European chip makers new opportunities in the market. After acquiring Mostek Corp., France's Thomson formed a joint venture with Italy's SGS in April 1987. Thomson, which is now Europe's second largest semiconductor manufacturer, is battling it out with Siemens and Philips for supremacy in the European semiconductor market.

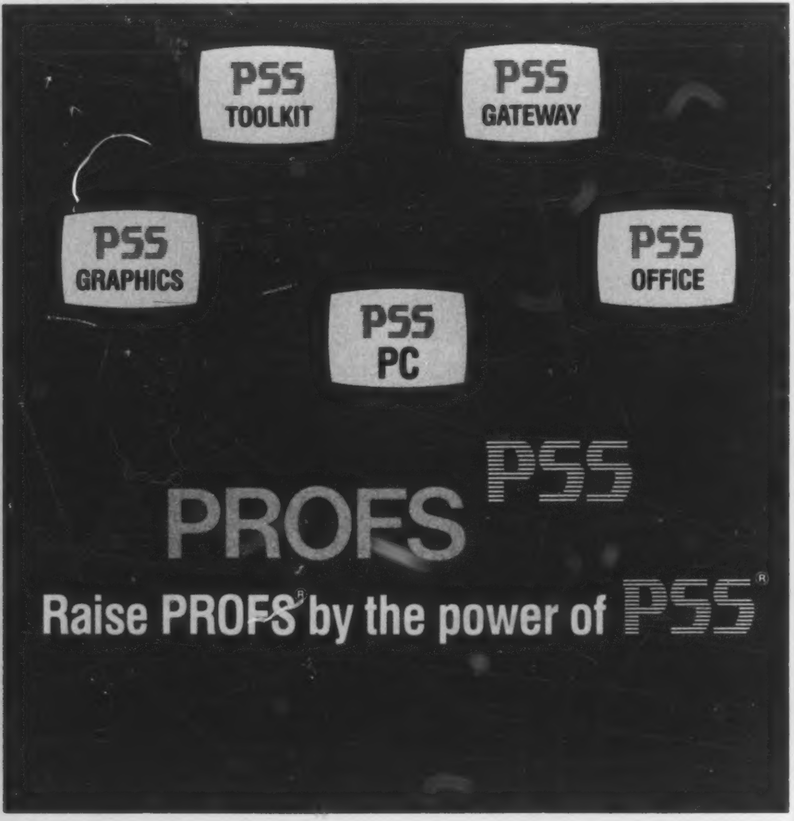
Last year marked a watershed for the European community, and the rippling effects are seen in the information technology industry. In 1987, the 12 member states of the European Commission enacted the Single European Act, which resolves to implement by 1992 a truly common market in Europe, with the free movement of goods, services, and people. Whether it is the source or the reflection of a new age of cooperation, the resolution is more than political pie in the sky. With the prospect of cooperative sanctions has come great activity and fresh thinking in the European IS industry: strategic mergers and alliances have been galvanized, standards efforts buoyed, and joint development efforts infused with new vigor.

On the governmental front, all public procurements of IS systems above $100,000 will now be subject to open bidding from vendors in all member countries. The liberalization of telecommunications, well under way in the U.K., is spreading throughout the European community, encouraging competition among telecom vendors.

At long last, vendors and users alike are genuinely cooperating in defining OSI functional profiles for key applications. SPAG (Standards Promotion and Application Group), formed by European IS vendors five years ago to promote standards, continued to focus its efforts on conformance testing.

Thanks to the continued efforts of X/Open, a consortium of European and U.S. firms, Unix emerged in 1987 as the prevailing software environment for future departmental systems, with all the major European vendors having significant Unix offerings. European IS vendors, which initially had to be enticed to participate in cooperative R&D programs with subsidies from the European Commission and national governments, are now seeing the payoffs of cooperation, and boundaries are falling. ■

Anthony Dunning is the IS manager of the European Commission's Directorate General for Telecommunications, Information Industries & Innovation in Luxembourg. Georges Anderla, an economist and lecturer in IS trends, is coauthor with Dunning of Computer Strategies: Technologies, Costs and Markets *(John Wiley & Sons, New York, 1987).*



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THE
DATAMATION
100

Technology Perspectives

MARKET CLOSE-UPS

Supplier-side views of seven market sectors: mainframes, minicomputers, microcomputers, software, services, peripherals, and datacom.

The DATAMATION 100 survey opens a window on the world of information systems and on a market that stretches from Canton, Ohio, to Canton, China. On the next seven pages, we present a view of 1987-vintage technology from the suppliers' side of that window.

DATAMATION selected representative vendors from the U.S., Europe, and the Far East, and asked them to provide technology overviews in one of the seven major market sectors: mainframes, minicomputers, microcomputers and low-end workstations, software, peripherals, computer services, and data communications. The system snapshots taken from the vendors' vantage point show a market in motion.

Herewith, 21 IS vendors measure the activity in 1987 and tell how it affects the key technologies on which you base your information systems.

Illustration by Darryl Ligasan

MAINFRAMES

Moving toward a new generation of distributed machines

Carl J. Conti
Vp & general manager
IBM Enterprise Systems

Information processing is becoming the lifeline of large organizations. A trend evolving within the community of large-systems users around the world is the desire to share information among more users within and across enterprises. We view this as a foundation block for future success in mainframes.

We have also recognized that data management, including knowledge-based systems and image processing, is an essential business requirement. As new applications continue to emerge, the need for faster access to stored data will lead to greater system capacity and responsiveness.

Another trend we saw in 1987 involved the role of the data center. As access to information grew, data centers were evolving to satisfy individual business needs. Depending on the industry, the information center could process data centrally or departmentally.

In response to changing customer needs, mainframe vendors must continue to improve the performance, availability, function, and data management capability of their large systems. This provides solutions for today and enables customers to build current investments to meet future demands.

Jacques Stern
Chairman and ceo
Groupe Bull

Since the early 1980s, the evolution in IS architectures has accelerated because of the convergence of information processing and communications technologies, and the proliferation of microcomputers. This acceleration has caused profound market upheaval.

Highly centralized systems are rapidly moving toward distributed architectures that are conceived around communications networks. The result is a temporary slowdown in the market, a slowdown that is aggravated by suppliers' difficulties in meeting new user needs for connectivity, integrated applications, and ergonomic interfaces.

The lack of communications standards between applications and systems has been at the heart of this problem, and suppliers and large users are now working to develop, implement, and promote the OSI (Open Systems Interconnection) model and other standards.

This will enable distribution of databases and communications between applications running on incompatible systems, improve the portability of applications, and increase productivity of development tools.

All of which means that there will be a new generation of truly distributed systems and renewed market growth by the 1990s.

Shoichi Ninomiya
Executive director
Fujitsu Ltd.

During 1987, we saw a changing role for the mainframe. Fueling that change were professional engineers and researchers who began to make more use of high-end workstations. There was also greater mainframe demand by customers that needed the vector-processing capability of supercomputers, and by those who needed greater transaction capability for management and data access systems for huge databases.

As distributed processing has progressed, users have begun to pay more attention to networking and the need for coherency among distributed resources. On the networking side, more OSI-based products were developed during 1987. There is an increasing need for clarification and standardization of interfaces, as the movement toward Unix exemplifies.

Customer need for more processing performance on mainframes and workstations will continue to grow, sparking fierce competition among manufacturers. Users' expectations in terms of distributed resource coherency and standards will speed up the development of integrated systems architectures that will tie together the mainframe, server, workstation, and the network. The eventual application of artificial intelligence to real business environments will generate the need for greater processing power and larger memory capacity.

The Top 15 in Mainframes

■ Amdahl and National Semiconductor again proved that being a pcm can be fun and profitable.

	DTM 100 RANK	COMPANY	1987 ($ MIL.)	1986 ($ MIL.)	$% CHANGE*	MKT. SHARE %†
1	1	IBM	11,193.0	10,891.0**	2.8	41.6
2	4	Fujitsu Ltd.	3,318.2	2,469.8	34.4	12.3
3	5	NEC Corp.	3,082.0	2,274.9	35.5	11.5
4	6	Hitachi Ltd.	1,850.4	1,371.4	34.9	6.9
5	3	Unisys Corp.	1,427.0	1,418.0**	0.6	5.3
6	14	Groupe Bull	962.8	822.3	17.1	3.6
7	29	Amdahl Corp.	926.2	502.5**	84.3	3.4
8	7	Siemens AG	695.5	582.4	19.4	2.6
9	20	STC plc	596.8	484.5	23.2	2.2
10	61	Cray Research Inc.	588.0	525.5	11.9	2.2
11	15	Control Data Corp.	510.0	475.0**	7.4	1.9
12	21	Honeywell Bull Inc.	370.6	340.2	8.9	1.4
13	47	National Semiconductor	362.0	300.0	20.7	1.3
14	33	Nippon Univac Kaisha Ltd.	226.9	169.4	33.9	0.8
15	26	Mitsubishi Electric Corp.	223.4	184.6	21.0	0.8

*In local currency, Fujitsu's mainframe revenues were up 15.3% to ¥479.8 billion; NEC's were up 16.3% to ¥445.7 billion; Hitachi's were up 15.8% to ¥267.6 billion; Groupe Bull's were up 1.6% to FF5.78 billion; Siemens' were down 1.2% to DM1.25 billion; STC's were up 10.4% to £365 million; Nippon Univac Kaisha's were up 15% to ¥32.8 billion; and Mitsubishi's were up 3.8% to ¥32.3 billion.

**Restated figures for 1986.

†Percentage share of DATAMATION 100 mainframe revenues.

MINICOMPUTERS

A major link in integrated, enterprisewide networks

William Demmer
Vp, midrange systems
Digital Equip. Corp.

To identify the three leading trends in the minicomputer segment, one must turn to the real trendsetters—the users. In 1987, users told us they wanted to network their terminals, pcs, and workstations with their departmental and data center systems. They wanted enterprisewide integration, so that information and resources can be shared across their entire organizations. All of which means that the term "minicomputer" is quickly fading, replaced by the term networked computer.

Second, users who are concerned about performance also realize that there is only one reliable standard—actual applications testing. Third, users continued to focus on software productivity in 1987. They want to develop an application once, then run it on a terminal, pc, or workstation tied to a system of any size in a networked applications environment that spans the entire enterprise.

In 1988, more and more large industrial, retail, and financial service organizations are implementing networks to gain a competitive edge in global markets. On the network side, there has been an increasing realization of the importance of internationally based standards, typified by the growing commitment to OSI efforts.

Klaus Luft
Chairman
Nixdorf Computer AG

Last year was a time of strong growth in distributed data processing. The midrange computer market was characterized by an increasing demand for powerful workstations, decentralized computer systems, and a trend toward networking and connectivity.

The growing integration of computer and telecommunications technologies was reflected by the increasing importance of the integrated services digital network. ISDN, combined with software solutions, represents the dawning of a new age of information processing.

The success of a computer company in future years will be determined by its capability to use these technologies to build customer-oriented hardware and software solutions.

The move toward open operating system architectures such as Unix will give customers flexibility and freedom of choice. The increasing use of distributed relational database management systems also will have a major impact on the industry.

Customers want a partnership with their vendor—a partnership that will provide systems for the best value and for a competitive edge. The ability to transfer technological know-how into customer solutions defines competence in the information technology business.

The Top 15 in Minis

■ It was DEC's year again, but watch out for Sun and welcome Wang back to the living.

	DTM 100 RANK	COMPANY	1987 ($ MIL.)	1986 ($ MIL.)	$% CHANGE*	MKT. SHARE %†
1	1	IBM	4,300.0	4,077.0**	5.5	19.9
2	2	Digital Equipment Corp.	3,248.4	2,688.5**	20.8	15.0
3	9	Hewlett-Packard Co.	1,221.0	1,100.0	11.0	5.6
4	11	Toshiba Corp.	919.6	765.5	20.1	4.2
5	12	Wang Laboratories Inc.	909.3	804.7	13.0	4.2
6	4	Fujitsu Ltd.	804.3	620.2	29.7	3.7
7	26	Mitsubishi Electric Corp.	644.3	474.7	35.7	3.0
8	10	Olivetti SpA	603.9	493.0	22.5	2.8
9	16	Nixdorf Computer AG	566.6	414.4	36.7	2.6
10	8	NCR Corp.	483.4	366.5	31.9	2.2
11	43	Tandem Computers Inc.	472.8	345.5	36.9	2.2
12	56	Sun Microsystems Inc.	453.5	204.6	121.7	2.1
13	3	Unisys Corp.	426.0	418.0**	1.9	2.0
14	33	Nippon Univac Kaisha Ltd.	400.1	310.3	28.9	1.8
15	49	Prime Computer Inc.	387.0	314.5	23.1	1.8

*In local currency, Toshiba's mini revenues were up 3.1% to ¥133 billion; Fujitsu's were up 11.3% to ¥116.3 billion; Mitsubishi's were up 16.5% to ¥93.2 billion; Olivetti's were up 6.5% to L783.2 billion; Nixdorf's were up 13.2% to DM1.02 billion; and Nippon Univac Kaisha's were up 10.7% to ¥57.9 billion.

**Restated figures for 1986.

†Percentage share of DATAMATION 100 mini revenues.

Keiichi Komiya
Vp & group executive, information processing & control systems group
Toshiba Corp.

Three major trends were in evidence last year in the worldwide market for medium-sized computers and minicomputers. First, 1987 was the year when Digital Equipment Corp., Sun Microsystems, and Tandem Computers all made remarkable progress with their own systems concepts. Second, conventional mainframe and pc manufacturers mounted a major counteroffensive against the makers of minis and midrange systems. In the micro realm, there was a notable shift to high-end machines.

Third, both users and suppliers focused more on systems integration in 1987. During 1988, mainframe makers will come to recognize the limits of their capabilities in systems integration, while users will become aware of the risks they run by depending on a single supplier. This means that each class of machine will be more sharply delineated within the computer market. Users need a superior network that can flexibly integrate the various classes of computers that are designed around different architectures.

This year, the growth rate of micros will outpace both midrange and mainframe systems, laptop sales will burgeon, and micro and mainframe de facto standards will become more important.

MICROCOMPUTERS

Playing a more powerful part in corporate processing

Delbert W. Yocam
Chief operating officer
Apple Computer Inc.

Last year was a momentous one in the personal computer industry. The era of 32-bit systems began with the introduction of major new microcomputer products, development platforms for solutions that will take users into the 1990s. The added power and features of 32-bit systems usher in substantially improved and integrated ways of solving problems.

In 1987, systems managers in large organizations sent clear signals to our industry. They said that multivendor computing environments will be the rule, not the exception. Therefore, it is incumbent on all hardware vendors to focus attention beyond the desktop and devote more resources to supporting the standards of the computer and telecommunications industry. Micro makers also must play a greater role in influencing the agreement on standards.

Information systems managers are assuming a more strategic role within their organizations. They are forcing pc companies to justify the strategic value of the equipment and solutions they offer—and rightly so.

For 1988, we expect the industry to have a second consecutive banner year in terms of sales, which will be driven partly by new solutions and partly by increased buyer confidence in pcs as products for long-term investment.

Vittorio Levi
Executive vice president, operations
Olivetti

The growth in the worldwide personal computer market was fueled by important product announcements and the widespread availability of new technologies and applications.

The following factors characterized 1987. First, the general availability of 80386-based personal computers that brought new performance levels and new applications to the micro market. Second, IBM's introduction of the PS/2 family, which created a discontinuity in terms of pc architectures because of incompatibilities in the new Micro Channel bus. Despite the PS/2, shipments of pcs based on traditional architectures significantly increased last year.

These factors, coupled with the availability of Microsoft's OS/2, will continue to play an important role in the pc market in 1988. This year will represent a time of change as user requirements become more sophisticated and technology and market standards evolve.

Users demand customized and flexible hardware platforms, advanced storage modules, advanced applications, and a consistent interface for MS/DOS pcs. Hardware technology will be a leading factor in developing new pc platforms, but this will only widen the gap between hardware and software availability.

Keun-Choong Kim
Managing director
Samsung Systems Div.

New processor technology has resulted in ever more powerful systems. The two major implementations of new 32-bit technology were Intel's 80386 processor and Motorola's 68030 processor. The 80386 is setting the pace in high-performance engineering workstations; the 68030 is being used in supermicrocomputers and parallel processing systems.

The microcomputer has become more than an isolated business tool. Communications technology has turned the microcomputer into more of a departmental or workstation system that's linked to a mini or mainframe host. Communications is also turning micros into nodes on a LAN. New graphics, storage, and printer technologies have enabled micros to perform such functions as desktop publishing and industrial design.

I expect continuous price-cutting at the low end of the microcomputer market in 1988. At the high end, I see a race to bring new technologies to market during the year. Despite the appreciation of major Asian currencies, manufacturers in these countries, taking advantage of decreasing manufacturing costs, will be able to supply the U.S. and Europe with ever cheaper clones of IBM PCs. At the high end of the market, IBM will be pitted against a series of competitors.

The Top 15 in Micros

■ **Sagging sales at AT&T helped drag down Olivetti, while Compaq, Amstrad, Zenith, and Apple soared to new heights.**

	DTM 100 RANK	COMPANY	1987 ($ MIL.)	1986 ($ MIL.)	$% CHANGE*	MKT. SHARE %†
1	1	**IBM**	7,007.7	6,150.0**	14.0	29.6
2	13	**Apple Computer Inc.**	2,069.0	1,331.0**	55.5	8.7
3	37	**Compaq Computer Corp.**	1,224.0	625.2	95.8	5.2
4	10	**Olivetti SpA**	1,176.0	1,268.9	-7.3	5.0
5	25	**Tandy Corp.**	1,132.2	997.0	13.6	4.8
6	3	**Unisys Corp.**	1,075.0	950.0**	13.2	4.5
7	46	**Zenith Electronics Corp.**	1,040.0	548.0	89.8	4.4
8	5	**NEC Corp.**	933.2	697.3	33.8	4.0
9	11	**Toshiba Corp.**	800.0	581.5	37.6	3.4
10	23	**AT&T**	540.0	600.0	-10.0	2.3
11	75	**Amstrad plc**	533.0	274.0	94.5	2.3
12	55	**Commodore Intl. Ltd.**	514.3	525.0	-2.0	2.2
13	9	**Hewlett-Packard Co.**	499.0	450.0	10.9	2.1
14	4	**Fujitsu Ltd.**	463.3	339.8	36.3	2.0
15	17	**Matsushita Elec. Indust.**	436.8	340.4**	28.3	1.8

*In local currency, Olivetti's micro revenues were down 19.3% to L1.53 trillion; NEC's were up 14.9% to ¥134.96 billion; Toshiba's were up 18.1% to ¥115.7 billion; Amstrad's were up 74.4% to £326 million; Fujitsu's were up 17% to ¥67 billion; and Matsushita's were up 10.2% to ¥63.2 billion.

**Restated figures for 1986.

†Percentage share of DATAMATION 100 micro revenues.

SOFTWARE

Uniform application interfaces span the systems spectrum

Jim Manzi
President
Lotus Development Corp.

There are three major trends evident in pc applications: users' desire for useful tools, applications that act as integrators, and a boom in CD-ROM technology.

Emerging pc applications will extend users' ability to create solutions. Work group computing and powerful new database servers and front ends will be linked to applications, allowing users to access data wherever the data reside.

A new type of productivity—transforming data into information, knowledge, and finally decisions—is enhanced by applications that connect resources, data, and people. Applications are taking on the integrator role in a multivendor environment, preserving existing investments by forward and backward compatibility and familiar user interfaces.

The value of CD-ROM lies in the value that applications add to raw information. I expect to see toolsets for multitasking pcs, paths between different pc operating environments and interfaces, and multiuser environments. This new generation of applications will share a concern for portability, connectivity, usability, extensibility, and quality. Revenues from electronic database publishing on CD-ROM in 1986 were $8.7 million. By 1991, these revenues will top $750 million, representing a compound annual growth rate of 149%.

Peter Schnell
President
Software AG

The most important trend in the systems software market is the unanimous desire among users to acquire the appropriate methods and tools for increasing developers' productivity.

These methods and tools, which shorten the long list of unimplemented applications, fall into three categories: fourth generation language technology, computer assisted software engineering, and program generators.

After the investment of substantial marketing resources, Structured Query Language (SQL), a new standard for interface to database management systems, was established. SQL could be considered real progress for users within the IBM systems software world. Replacing the previous "native call" interfaces to IMS and DL/1, SQL is far easier to use in the implementation of new applications.

The wide variety of hardware offered today makes it necessary to use different processors and architectures in heterogeneous networks. The trend toward systems software that transparently uses heterogeneous networks of hardware still has a long way to go. This systems software hides the complexity of using different architectures in a system that is completely independent of the application itself.

Takeo Miura
Senior executive
Managing director
Hitachi Ltd.

There were two major trends that had an impact on the systems software area of the information systems market last year. One involved the development of architectures that have complete application interfaces across a full range of machines—from very large systems to workstations.

The second was the development of architectures that reinforced horizontal connectivity among departmental computers. Such architectures support a broad range of processors and functions, including office automation.

In 1988, more products that provide a uniform applications interface for all computers will be added to the worldwide market. Also this year, more will be done to strengthen network functions through support of the integrated services digital network and through the implementation of the International Organization for Standards' Open Systems Interconnection.

There will be activity in 1988 on the customer side of the fence as well. Users everywhere are seeking help in the applications development process. More tools and techniques for increasing the productivity of applications development efforts will be available this year, and more steps will be taken to improve the user friendliness of technology.

The Top 15 in Software

■ The merger of Computer Associates and Uccel created the largest independent software company.

	DTM 100 RANK	COMPANY	1987 ($ MIL.)	1986 ($ MIL.)	$% CHANGE*	MKT. SHARE %†
1	1	**IBM**	6,836.0	5,514.0	24.0	40.2
2	3	**Unisys Corp.**	1,163.0	938.0**	24.0	6.8
3	2	**Digital Equipment Corp.**	691.1	560.0	23.4	4.1
4	5	**NEC Corp.**	676.0	507.1	33.3	4.0
5	7	**Siemens AG**	550.8	386.8	42.4	3.2
6	4	**Fujitsu Ltd.**	515.9	389.2	32.6	3.0
7	66	**Computer Assoc. Intl.**	497.6	226.5	119.7	2.9
8	6	**Hitachi Ltd.**	448.8	331.0	35.6	2.6
9	9	**Hewlett-Packard Co.**	415.0	375.0	10.7	2.4
10	16	**Nixdorf Computer AG**	405.8	299.3	35.6	2.4
11	78	**Microsoft Corp.**	397.3	260.2	52.7	2.3
12	88	**Lotus Dev. Corp.**	395.6	283.0	39.8	2.3
13	10	**Olivetti SpA**	347.9	225.5	54.3	2.0
14	108	**Ashton-Tate**	267.3	210.7	26.9	—
15	112	**Management Sci. America**	256.6	193.5	32.6	—

*In local currency, NEC's software revenues were up 14.4% to ¥97.8 billion; Siemens' were up 17.9% to DM990 million; Fujitsu's were up 13.7% to ¥74.6 billion; Hitachi's were up 16.4% to ¥64.9 billion; Nixdorf's were up 12.2% to DM729.3 million; and Olivetti's were up 34.2% to L451.2 billion.

**Restated figures for 1986.

†Percentage share of DATAMATION 100 software revenues.

COMPUTER SERVICES

Taking on a bigger role as systems integrators

Les Alberthal
President and ceo
Electronic Data Systems

Three major trends affecting today's computer services industry are the effort to master the variety and complexity of emerging technologies; the need for commercial systems integration; and the pressure for companies in deregulated markets to be more competitive.

The accelerating availability of a wide range of affordable and powerful alternatives has exceeded the ability of many businesses to absorb them, frustrating business leaders as they endeavor to evaluate their investments in hardware, software, and personnel.

The second trend involves the emerging market of large commercial users seeking systems integration solutions. This need results from the diversity and lack of standards in information and communications products.

The third trend pertains to deregulation in such industries as communications, banking, and utilities. Companies in this environment are intently focusing on their information and communications systems to gain competitive edge.

There will be a greater emphasis on the electronic sharing of information, particularly between companies. This real-time capability will require expertise that the computer services industry can provide to integrate dissimilar components, systems, and business practices.

Serge Kampf
Chairman and ceo
Cap Gemini Sogeti

Ups and downs in growth experienced by dp manufacturers did not affect computer services, which continued to enjoy a healthy average growth rate of 20%. This is a reflection of customers' desire to improve their competitiveness, which is achieved through increased productivity and quality service to the end user.

Customers' quests for personnel evolved during 1987 into a quest for solutions. Some large professional services companies qualified as prime contractors on turnkey systems integration projects. Demand for complex, heterogeneous communications networks with user-friendly interfaces drove vendors to adopt more sophisticated marketing structures that are horizontal by technique and vertical by user category. Strategic partnerships with manufacturers continued to be a reality in the services industry.

The trend toward contracting out will continue. Reductions in the cost of hardware will enable services companies to secure a more significant share of total dp budgets. This year should be one of record income growth and one in which we achieve greater professional recognition for the computer services industry.

Yasuichi Toda
Executive vice president
NRI & NCC Co. Ltd.

In 1987, we saw the full-fledged introduction of strategic information systems by users. Last year, there was also a clear recognition of the importance of systems integration by data processing manufacturers, information service firms, and consulting companies.

The third most important trend in the worldwide computer services sector involved offshore opportunities. Some major American information service companies entered the Japanese market last year. Likewise, some large Japanese service firms established local subsidiaries in a number of foreign nations.

I expect to see three major trends in the computer services industry during 1988. First, the gap will widen between corporations capable of providing high-level professional services and those that cannot. Those high-level services include systems integration and consulting. Second, there will be additional companies entering the information services industry from nonrelated sectors. What they will want to do is capitalize on an industry that has the highest estimated growth rate in the industrial world.

The third major trend concerns value-added network service. Following the opening of the U.S.-Japan link, there will be increasing competition for international VAN network service between Japan and Britain, since there is now deregulation on that route.

The Top 15 in Services

Acquisitions fueled Cap Gemini's growth, but EDS and Arthur Andersen did it all on their own.

	DTM 100 RANK	COMPANY	1987 ($ MIL.)	1986 ($ MIL.)	$% CHANGE*	MKT. SHARE %†
1	24	TRW Inc.	1,780.0	1,450.0	22.8	11.7
2	30	ADP Inc.	1,467.0	1,298.1	13.0	9.7
3	31	Electronic Data Systems	1,440.5	1,125.9	27.9	9.5
4	41	Computer Sciences Corp.	1,133.8	977.7	16.0	7.5
5	3	Unisys Corp.	1,120.0	1,093.0	2.5	7.4
6	15	Control Data Corp.	896.4	872.7**	2.7	5.9
7	1	IBM	850.0	750.0**	13.3	5.6
8	35	McDonnell Douglas Corp.	830.2	803.2	3.4	5.5
9	58	Arthur Andersen & Co.	705.9	546.0	29.3	4.7
10	63	Martin Marietta	685.7	659.4	4.0	4.5
11	64	Cap Gemini Sogeti	682.3	420.1	62.4	4.5
12	42	Nippon Teleg. & Teleph.	565.6	450.5**	25.5	3.7
13	53	General Electric Co.	450.0	450.0**	0.0	3.0
14	85	Emhart Corp.	404.8	356.0	13.7	2.7
15	8	NCR Corp.	396.0	350.0	13.1	2.6

*In local currency, Cap Gemini's services revenues were up 40.9% to FF4.1 billion and NTT's were up 7.7% to ¥81.8 billion.

**Restated figures for 1986.

†Percentage share of DATAMATION 100 services revenues.

PERIPHERALS

Terminals and nonimpact printers leave a mark on a market

Phillip White
Pres. & chief oper. officer
Wyse Technology

The year 1987 was a time of vendor consolidation in the terminal marketplace. Many smaller vendors faced growing competition and dramatically eroding prices. Lacking sufficient resources for heavy R&D investment and unable to ship in extremely high volumes, they saw their prospects of long-term survival diminishing. The larger vendors saw acquisitions as a relatively painless way to broaden their scope and increase their market share.

Influenced by pull-through demand from the increasingly sophisticated pc market, terminal vendors began implementing such features as affordable graphics and color into their products. For the first time, these capabilities were standard features on general purpose terminals. Formerly, these features were available only on more costly, dedicated terminals.

The "pc terminal," with its pc-style keyboard and pc screen emulation, became a viable alternative to the personal computer in the multiuser systems market. This new market segment took hold because it offered users lower-cost options and greater security than did pcs.

The major trends in the pc market—the entrenchement of networking and the proliferation of standards-based, multiuser micros—have created significant new opportunities for terminal use.

Giorgio Ronchi
Chairman and ceo
Memorex-Telex Corp.

There was a slowdown last year in demand for nonimpact printers for high-end mainframes caused by software bottlenecks and the lack of product differentiation. These, in turn, adversely affected disk drive growth. Market expansion was faster in the midrange, the pace quickened by products outside the IBM camp. A major factor in 1987 was slower than expected acceptance of cartridge tape technology. Customers, who expected prices to fall and performance to improve, took a wait-and-see attitude.

On the other hand, customers last year displayed a more favorable attitude toward pcm equipment, both cpu and peripherals. There was increasing interest in solid-state disk drives, automatic tape libraries, optical disk devices, and midrange, nonimpact printers.

Unit price erosion of 3270 terminals and control units, which carry longer-term warranties, generated higher demand for these products in 1987. A larger screen size (14 inches), new features, and improved ergonomic attributes also contributed to this higher demand.

The 3270 network can now handle a variety of intelligent and nonintelligent terminals. This year, there will be more demand for 3270 nets to be compatible with other networks, and the increased ease of networking will expand the market for intelligent workstations.

Hideaki Yasukawa
Executive vice president
Seiko Epson Corp.

One of the most important trends in the peripherals sector last year was the expanding market share of nonimpact printers.

The ink-jet printer, which offers higher print quality and speed and lower costs and noise, had a significant influence on the market in 1987. However, laser printers, which were reduced in price last year, continued to garner the largest percentage of sales.

In the impact category, dot matrix machines range from very basic models all the way up to sophisticated and highly developed printers. The ability to produce multiple sharp copies and finer letter-quality printing are the two biggest advantages of dot matrix printers, which will continue to maintain their market position during 1988. The growing popularity of desktop publishing will strengthen the overall demand for printers, which are among the crucial devices in this new application. In the memory field, the hard disk is becoming more suitable because of its larger storage capacity. The optical disk drive, currently under development, is also expected to become more important in the memory arena.

In the display area, a new type of black-on-white LCD that provides higher contrast and a wider viewing angle was developed.

The Top 15 in Peripherals

■ Seagate ate Control Data's lunch while IBM posted its first decline in peripherals revenues in years.

	DTM 100 RANK	COMPANY	1987 ($ MIL.)	1986 ($ MIL.)	$% CHANGE*	MKT. SHARE %†
1	1	IBM	8,725.0	9,279.0**	-6.0	16.4
2	6	Hitachi Ltd.	3,036.2	2,321.9	30.8	5.7
3	2	Digital Equipment Corp.	2,764.7	2,270.0**	21.8	5.2
4	5	NEC Corp.	2,270.1	1,774.8	27.9	4.3
5	4	Fujitsu Ltd.	2,164.0	1,624.1	33.2	4.1
6	8	NCR Corp.	1,808.4	1,564.7	15.6	3.4
7	9	Hewlett-Packard Co.	1,735.0	1,525.0	13.8	3.3
8	19	Xerox Corp.	1,560.0	1,300.0	20.0	2.9
9	7	Siemens AG	1,502.3	1,167.2	28.7	2.8
10	3	Unisys Corp.	1,307.0	1,286.0**	1.6	2.5
11	16	Nixdorf Computer AG	1,250.9	920.9	35.8	2.4
12	17	Matsushita Elec. Indust.	1,185.1	847.5	39.8	2.2
13	14	Groupe Bull	1,172.1	1,001.0	17.1	2.2
14	44	Seagate Technology	1,075.7	709.4	51.6	2.0
15	15	Control Data Corp.	974.5	1,075.0	-9.4	1.8

*In local currency, Hitachi's peripherals revenues were up 12.2% to ¥439.1 billion; NEC's were up 9.8% to ¥328.3 billion; Fujitsu's were up 14.3% to ¥312.9 billion; Siemens' were up 6.5% to DM2.7 billion; Nixdorf's were up 12.4% to DM2.25 billion; Matsushita's were up 20% to ¥171.39 billion; Groupe Bull's were up 1.6% to FF7.04 billion.

**Restated figures for 1986.

†Percentage share of DATAMATION 100 peripherals revenues.

DATA COMMUNICATIONS

The drive toward open systems picks up speed, support

John Lockitt
President
Codex Corp.

High speed digital transmission systems are integrating voice and data into private communications networks. Datacom equipment has evolved from hardware intensive to software intensive. Customers are asking for total networking solutions, products that link networks that are changing from analog to digital, networks that feature a variety of processing elements from a number of manufacturers, and networks that adhere to evolving, open systems standards. In 1988 and beyond, development of network management systems will track the evolution of the communications networks they manage. As users migrate toward dial and digital technologies and onto ISDN, management systems will pull these technologies together under one umbrella. Open systems standards will play a key role in the integrated management of multivendor, heterogeneous networks.

Private utility networks will be the single, physical backbone over which multiple, logical subnetworks will run. As a result of the need to facilitate voice/data integration and for higher-capacity backbones in data networks, the burgeoning growth of T1 circuits and transmission equipment will continue.

Claus Kessler
Executive vp, head of communications & IS group
Siemens AG

The "office of the future" concept will be a driving force for innovation and growth in the worldwide computer and communications marketplace. Systems integration and innovative solutions for office and datacom are key applications areas.

International standardization and the commitment by vendors and users to open standards are also important prerequisites. The systems competing in the worldwide PBX market will be differentiated more and more on the basis of software. Approximately 80% of the development costs for an integrated PBX system is now spent on software. And that software development process is being pursued on a worldwide scale.

There are four integration steps in the evolution of the digital PBX market: the integration of the transmission medium, which translates into one single user connection; the combination of different functions in one terminal, which can be called a "unified user desk terminal"; the integration of applications that provide all-in-one operation; and the integration of island networks into an interconnected corporate network.

Nobuhiko Shimasaki
Corporate chief engineer
NEC Corp.

The three most significant trends in the worldwide data communications field pertain to ISDN, the standardization of OSI, and ongoing developments in radio communications.

ISDN will integrate datacom, computer communications, and telephone communications services. Commercial ISDN service will begin in Japan this year, and enterprises and companies are equipping their digital PBXs with ISDN interfaces.

The current standardization of OSI protocols is increasingly important in multivendor computer and communications environments. OSI, which is reaching the stage of practical use, eventually will be incorporated into ISDN. In radio communications, the use of satellite and mobile communications represents a significant development in the spread of data communications technology. Satellite and mobile communications technologies could be used in global, nationwide services as well as in regional and local data communications services. As these trends show, datacom is maturing, evolving into a fundamental social technology, a technology that is fast becoming a public utility. The age of personal data communications is just around the corner. ■

Senior editor Linda Runyan coordinated the Technology Perspective project, with the help of editorial secretary Anne M. Mangieri.

The Top 15 in Datacom

■ Vicious pricing in PBXs knocked AT&T's revenues down and limited growth at Northern Telecom.

	DTM 100 RANK	COMPANY	1987 ($ MIL.)	1986 ($ MIL.)	$% CHANGE*	MKT. SHARE %†
1	1	IBM	1,507.0	1,331.0**	13.2	10.0
2	7	Siemens AG	1,402.1	1,095.8	28.0	9.3
3	22	Alcatel NV	1,037.6	0.0	0.0	6.9
4	23	AT&T	1,010.0	1,075.0	-6.1	6.7
5	51	Northern Telecom Ltd.	865.0	800.0	8.1	5.7
6	5	NEC Corp.	842.1	748.0	12.6	5.6
7	11	Toshiba Corp.	760.6	534.1	42.4	5.0
8	27	Canon	742.9	369.4	101.1	4.9
9	17	Matsushita Elec. Indust.	680.2	503.2**	35.2	4.5
10	4	Fujitsu Ltd.	674.4	531.0	27.0	4.5
11	34	Ricoh Company Ltd.	590.9	408.4	44.7	3.9
12	28	LM Ericsson	529.0	470.6**	12.4	3.5
13	60	Motorola Inc.	528.0	465.0	13.6	3.5
14	18	NV Philips Gloeilampenfabrieken	518.3	428.6	20.9	3.4
15	74	Racal Electronics plc	488.7	416.4	17.4	3.2

*In local currency, Siemens' datacom revenues were up 5.9% to DM2.52 billion; Alcatel's were FF900 million; NEC's were down 3.4% to ¥121.79 billion; Toshiba's were up 22.2% to ¥110 billion; Canon's were up 72.6% to ¥107.44 billion; Matsushita's were up 16% to ¥98.36 billion; Fujitsu's were up 9% to ¥97.5 billion; Ricoh's were up 24.2% to ¥85.46 billion; Ericsson's were up .05% to $kr3.35 billion; Philips' were flat at G1.05 billion; and Racal's were up 5.25% to £298.9 million.

**Restated figures for 1986.

†Percentage share of DATAMATION 100 datacom revenues.

THE DATAMATION 100

1988-What's Ahead

THE AGE OF VOLATILITY

Sales and profits are high, but spirits are low. What's at work? Change—faster and more furious than ever.

The world's top IS vendors are in the best shape in years. And yet, all are uncertain just how long they can maintain their health. What worries companies from No. 1 IBM to No. 100 Gould is the same factor that troubles most of the DATAMATION 100's best customers—volatility.

Financially, the DATAMATION 100 could hardly be better off. Corporate revenues are up 3.1%. IS sales are ahead 18.7%. Earnings are 27.2% higher. Head count is 12% lower. R&D outlays still represent nearly 6% of sales.

They are equally fit technologically. A new product-cycle wave of high-performance workstations, multiprocessing minis, network management systems, and DBMSs is meeting customer acceptance. Pc-related technologies, in particular, have propelled many companies upward through the ranks of the DATAMATION 100.

Illustration by Daryl Ligason

Psychologically, however, members of the DATAMATION 100 are suffering. The market crash, the unrelenting pace of mergers and acquisitions, rapid globalization of world markets with their fluctuating currencies, and the accelerated pace of technology all have taken their toll. The top executives of DATAMATION 100 companies have reached the point where they sound simply glum at every appearance—even when they're announcing favorable results for their companies.

"High-growth companies are always subject to some degree of volatility, and Digital is no exception," pointed out James M. Osterhoff, Digital Equipment Corp.'s chief financial officer, in disclosing that the world's No. 2 IS vendor began the year with 17% growth in revenues. "The information industry is a volatile one and IBM is subject to that volatility," echoed IBM chairman John Akers shortly after his company reported a 10% gain in first-quarter revenues.

It's Not Business as Usual For Users

Will next year's DATAMATION 100 change as radically as these warnings suggest? Hardly. With one exception, the top 26 companies in this year's ranking are the same vendors that made the top of last year's list. And they're likely to retain that ranking in 1988, barring any major swings in world currencies or similar economic catastrophe.

That doesn't mean business as usual, however, for users in dealing with their IS suppliers. This year's DATAMATION 100 data and profiles suggest that organizations—particularly those in the private sector—will be buying significant quantities of systems, networks, etc., from new IS sources in 1988.

DATAMATION EDITOR-IN-CHIEF TIM MEAD

The most striking evidence pointing in this direction lies in the microcomputer segment of the DATAMATION 100. Micros have grown to represent 11.1% of annual worldwide IS revenues in the span of five years. Moreover, vendors that make micros or related products such as disk drives and software are climbing fastest in the ranks of the world's top IS suppliers.

In this year's ranking, for example, Apple jumped five places to No. 13; Compaq leaped 17 places to No. 37, Seagate advanced six steps to No. 44, and Amstrad skyrocketed onto the list at No. 75. Several smaller micro-related companies also are knocking loudly on the DATAMATION 100's door—Acer at No. 101, AST Research at No. 103, Micropolis at No. 104, and Ashton-Tate at No. 108.

Equally persuasive, but in a negative mode, is the fall that several traditional mini suppliers took this year. Data General slid four places to No. 32, Prime fell six to No. 49, TI dropped 12 slots to No. 59, Harris stumbled 17 places to No. 81, Datapoint plummeted 19 places to No. 98, and Gould slipped 14 notches to No. 100.

Technology is but one force reshaping user-vendor relationships. The other is globalization. As U.S.-based organizations continue to expand overseas, they're likely to best meet some business challenges with products and services supplied by native IS vendors. Likewise, Japanese and European users may come to rely on U.S.-based IS suppliers to support their widening American operations.

European Vendors Attack U.S. Markets

European vendors seem to be more keenly aware of this phenomenon than others, aggressively attacking their own and U.S. markets via heady acquisitions and savvy sales campaigns. Their efforts are paying off. Inspectorate International appears as No. 36 on this year's DATAMATION 100. Société Générale debuted at No. 48. Atlantic Computers leapfrogged 15 places to No. 50. And Cap Gemini Sogeti inched up two places to No. 64. More recently, two of Europe's IS kingpins—Siemens and Nixdorf—managed to work their way to center stage alongside IBM, DEC, and Hewlett-Packard by announcing their support of open systems technology. The move has to help their efforts to penetrate the U.S. market.

U.S.-based users unprepared to give Nixdorf and others serious consideration as an IS supplier ought to examine why. European users that give U.S vendors short shrift ought to do the same. Ditto for Far Eastern users that can't see past Tokyo.

Simply put, users and vendors are going to have to get used to change. The Information Age is passing into the Age of Volatility. ■

Vital Signs Look Positive

The DATAMATION 100 grows more IS intensive and more profitable. But the industry's top performers have applied the brakes on R&D spending and downsized staff operations.

	1986	1987	CHANGE
Total Revenues	$705.4*	$727.2*	3.1%
IS Revenues	$176.0*	$208.9*	18.7%
IS Rev./Tot. Revenues	25.0%	28.7%	+3.7
Net Income	$22.4*	$28.5*	27.2%
Corporate R&D	$41.8*	$42.0*	0.5%
Corp. R&D/Tot. Revenues	5.9%	5.8%	-0.1
Employees	5,773,269	5,092,444	-11.8%
Tot. Rev./Employee	$122,184	$142,800	16.9%

*Figures in billions of dollars

Source: Company Reports/DATAMATION Estimates

Tim Mead

TIM MEAD
EDITOR-IN-CHIEF